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MEMORANDUM REPORT NO. 2057

AIR BLAST STUDIES OF LARGE AMMONIUM NITRATE/FUEL OIL EXPLOSIONS

by

Louis Giglio-Tos
Ralph E. Reisler

August 1970

U.S. ARMY ABERDEEN RESEARCH AND DEVELOPMENT CENTER
BALLISTIC RESEARCH LABORATORIES
ABERDEEN PROVING GROUND, MARYLAND

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B A L L I S T I C R E S E A R C H L A B O R A T O R I E S

MEMORANDUM REPORT NO. 2057

AUGUST 1970

AIR BLAST STUDIES OF LARGE AMMONIUM NITRATE/FUEL OIL EXPLOSIONS

Louis Giglio-Tos
Ralph E. Reisler

Terminal Ballistics Laboratory

Program was partially supported by the Defense Atomic Support Agency Project No. NA 007-07

A B E R D E E N P R O V I N G G R O U N D, M A R Y L A N D

B A L L I S T I C   R E S E A R C H   L A B O R A T O R I E S

MEMORANDUM REPORT NO. 2057

LGiglio-Tos/REReisler/mba
Aberdeen Proving Ground, Md.
August 1970

AIR BLAST STUDIES OF LARGE AMMONIUM NITRATE/FUEL OIL EXPLOSIONS

ABSTRACT

Air blast was measured from the detonation of three hemispherical ammonium nitrate/fuel oil charges; 2 - 20 tons and 1 - 100 tons. Strain-type pressure transducers and magnetic tape recording systems were used to record the air blast parameters over the moderate to high pressure region. Comparison made with hemispherical TNT data shows an effective weight of 0.83 of TNT on the basis of overpressure measurements in the 200 to 30 psi region.

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1. INTRODUCTION

1.1 Background

Since the nuclear moratorium was enacted in 1958, chemical explosives have been used as a substitute for nuclear devices to generate an air blast environment for phenomenology and target response studies. Such large simulant HE charges have been constructed from blocks of TNT, 12" x 12" x 4", weighing 33 pounds. The geometric configuration of these charges was that of a hemisphere or a sphere positioned above, below or on the ground surface and sometimes half buried according to the objectives of the particular program. A typical TNT charge is shown in Figure 1.1. Cost effectiveness and other considerations dictate an examination of the expenses involved and a search for other charges that would be equal to or better than TNT yet less expensive. This would mean the charge would be easily handled, safe, with an output performance and reproduciability near that of TNT. The Naval Ordnance Laboratory (NOL) through the sponsorship of the Defense Atomic Support Agency (DASA) undertook a study of ammonium nitrate/fuel oil (AN/FO) charges as a potential candidate. Phase I of this study was carried out with 23 charges ranging in weight from 260 to 4,090 pounds (see Reference 1)*. The AN/FO material was shaped into a hemisphere on the ground surface by two means: one was with a corrugated cardboard fence and the second was a stack of bagged material. Complete detonation was achieved in all tests. Blast characteristics were reproducible over the range of interest. An effective weight of 0.82 of TNT was determined on the basis of over-pressure measurements in the 30 to 0.5 psi region.

The second part of this study was to investigate the usefulness, reliability, predictability, economy and ease in handling of large amounts of AN/FO. Three large hemispherical shots were scheduled. There were to be two shots of twenty tons; one formed by the stacking of bags of AN/FO and filling the voids with loose material, (see Figure 1.2), and one formed by the containment of the bulk material with a

*References are listed on Page 52

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Figure 1.1 Typical 20 Ton TNT Block Built Charge

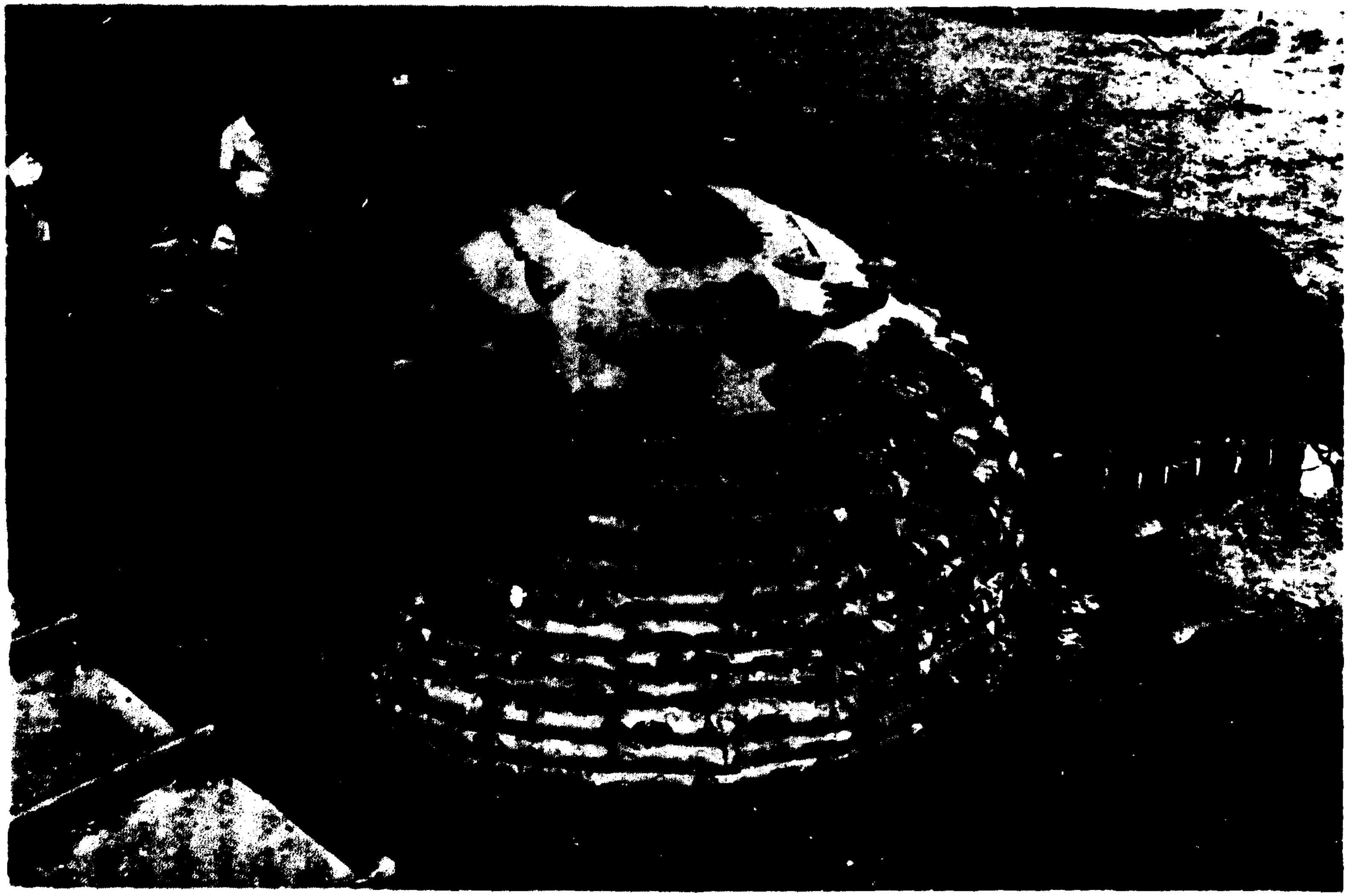

Figure 1.2 Twenty Ton Bagged Charge, AN/FO 1

fiberglass hemisphere having an open top, (see Figure 1.3). The third shot was to be a 100 ton event formed in like manner to the 20 ton fiberglass container. The AN/FO used was mixed at the site from raw prilled ammonium nitrate and No. 2 diesel fuel in a 94.5/5.5 percent by weight ratio. Figure 1.4 is a photograph of the mixing operation. A red dye was used to color the fuel oil to aid in identifying a thorough mix. All charges were fired with a booster of 250 lbs of TNT with a 50/50 Pentolite Primer. Initiation was made by a length of primacord and an Engineers Special Detonator. Additional details of the charge design may be found in the NOL final report (Reference 2).

As a result of the planning of the Technical Cooperation Program, Panel N-2 in April 1969, the Watching Hill test range of the Defence Research Establishment, Suffield (DRES), Canada was selected as the site for conducting the trials. The three events were scheduled for the last three weeks of August 1969. Major responsibilities for the conduct of the program were delegated to DRES and NOL; DRES was responsible for overall layout planning and survey, installation of the power and control cables to all bunkers and the detonation lines to the charge, safety of the trial layout, and the detonation of the charge. Control was exercised from the DRES timing console which furnished logic to the recording stations and the detonation pulse to the charge. The NOL was responsible for the movement of the materials, the mixing in the field, and the placement of the charge. Reference 3 indicates the extent of the overall program.

1.2 Objectives

The objectives of the Ballistic Research Laboratories (BRL) in this experiment were to measure, analyze, and compare the air blast characteristics resulting from the detonation of the three AN/FO charges with data from previous TNT tests. The free field air blast environment was to be defined over the region 3000 psi to 50 psi. Parameters to be acquired were: arrival time, maximum overpressure, positive phase duration, and positive overpressure impulse. A number of total head pressure measurements were also planned to obtain dynamic

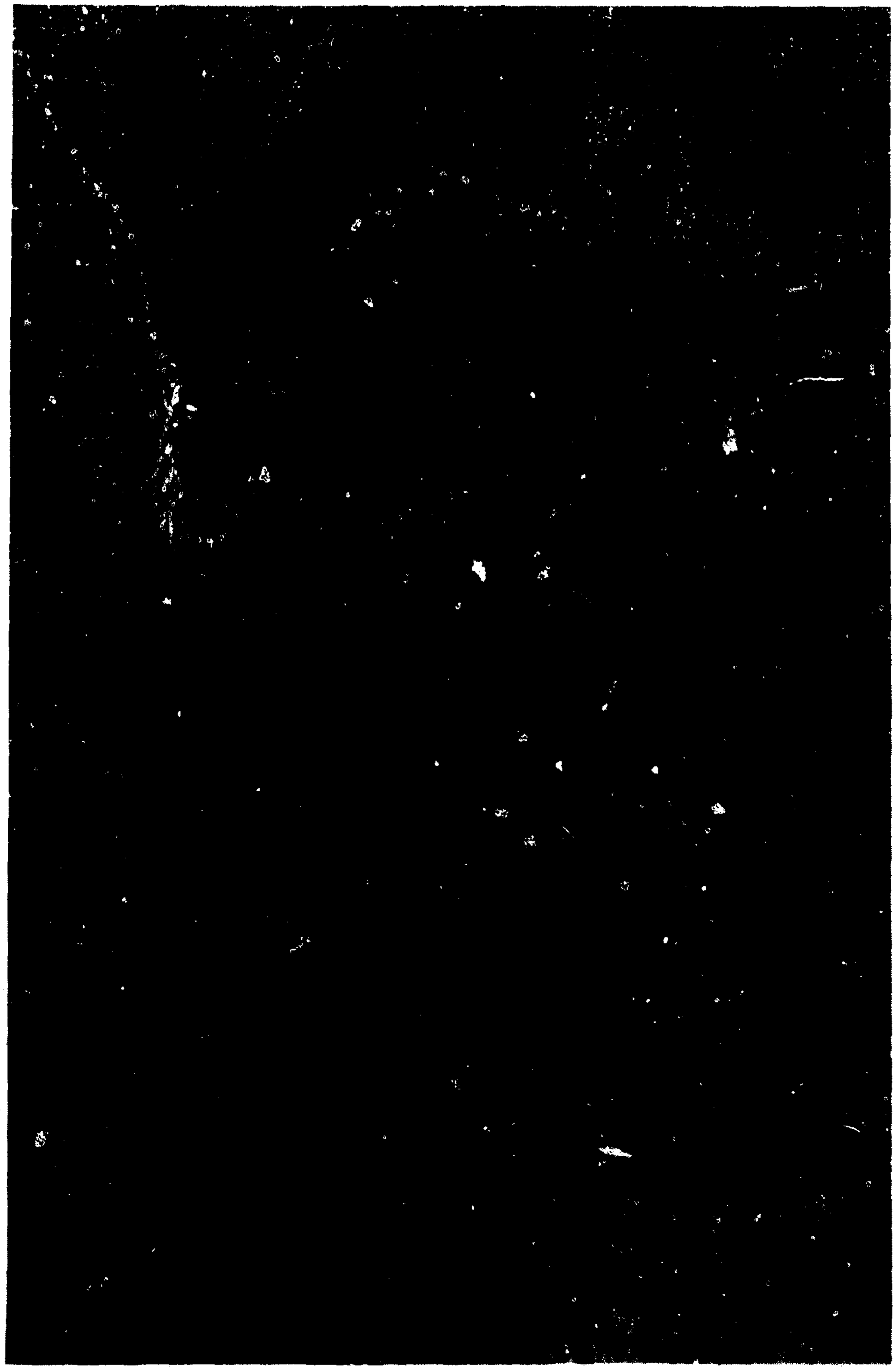

Figure 1.3 One Hundred Ton Bulk Encased Charge AN/FO 3

Figure 1.4 AN/FO Mixing Equipment Preparing AN/FO 2

pressure and dynamic pressure impulse data.

2. EXPERIMENT DESIGN

2.1 Field Layout

The Watching Hill test range of DRES was selected as the site for the series of AN/FO detonations in order that the existing HEST test structure from Operation Prairie Flat might be retested by the 100 ton event. This established the ground zero of the 100 ton at a point directly west of the Prairie Flat LN 321 test silo. The 20 ton shots were then located approximately 500 feet to the southwest of the 100 ton zero, 160 feet apart to allow for the installation of instrument stations which could be used for both events, (see Figure 2.1). Cabling to the instrument recording van, which was located for a previous experiment, was placed in a single trench running 4000 feet to the trailer. Following the first 20 ton shot, it was planned to fill in the crater and clean up the surrounding area preparatory to firing the second 20 ton charge.

Figures 2.2, 2.3 and 2.4 show the instrument stations established to cover the pressure ranges of interest.

2.2 Instrumentation

The recording system consisted of five basic components: (1) the transducer, (2) the signal conditioning equipment, (3) the signal amplifier, (4) the FM record amplifier, and (5) the magnetic tape recorder.

Bytrex HFG pressure transducers were used. This transducer uses a four arm Wheatstone bridge with two active semiconductor arms and two dummy arms. The semiconductor strain gages are bonded to a force summing column which is attached to a force collecting diaphragm. The transducer has the basic configuration of a 1-1/8" diameter threaded cylinder 3" long and is supplied with a shield over the force summing area of the diaphragm to protect it from thermal radiation and debris damage. The transducers have natural frequencies of 30 to 100 KHz depending upon the range.

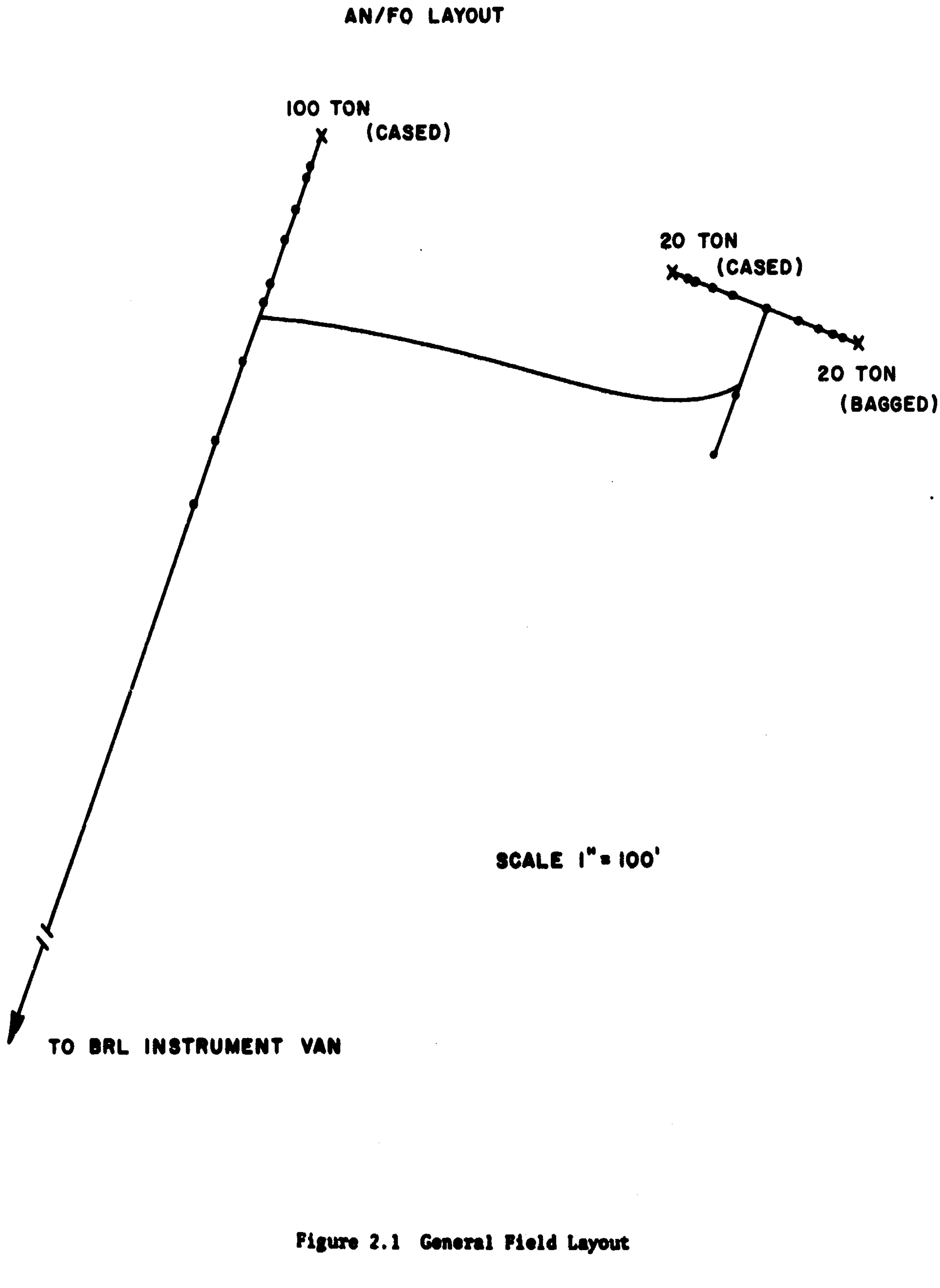

Figure 2.1 General Field Layout

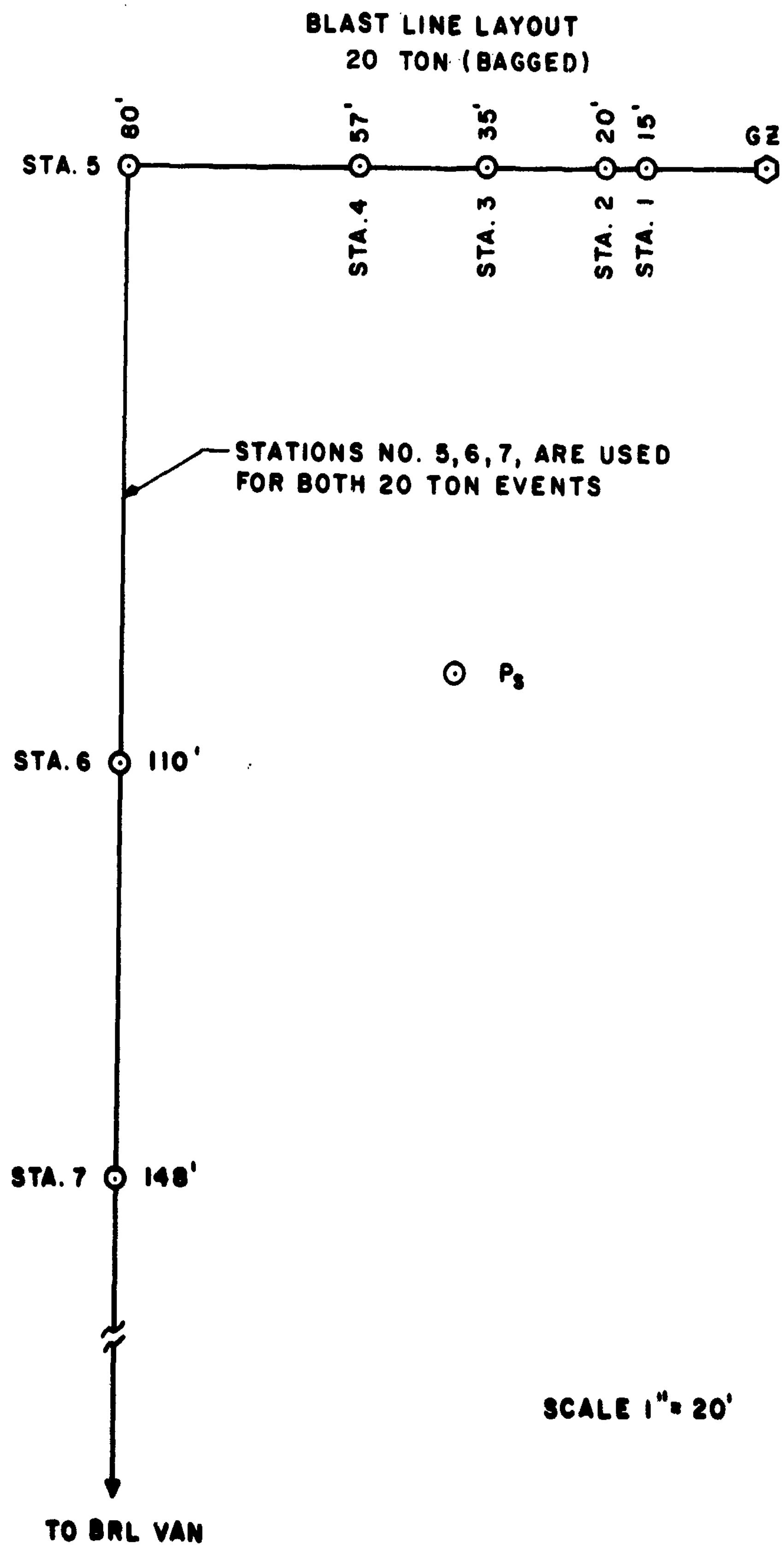

Figure 2.2 Instrument Layout, AN/FO 1

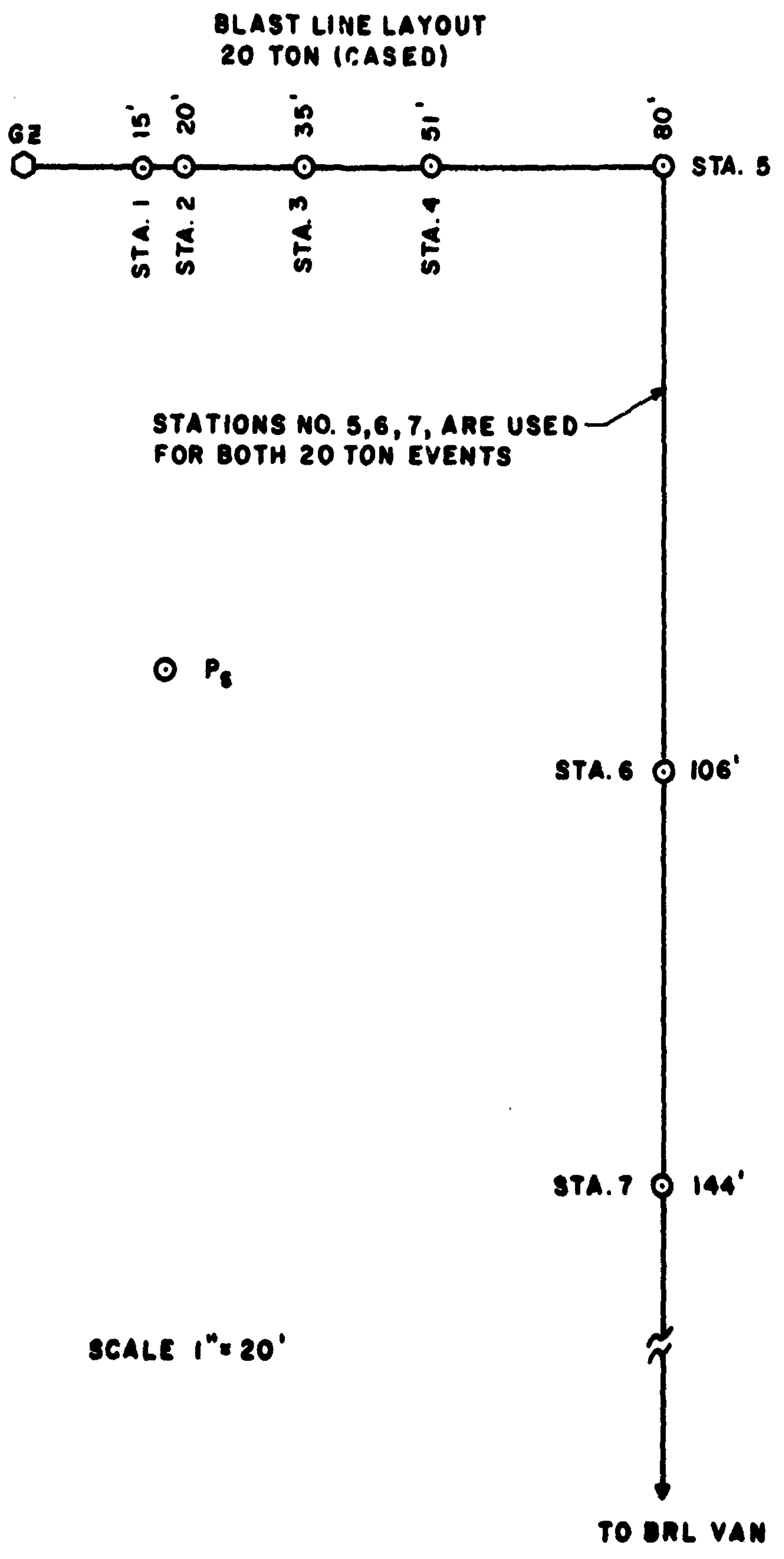

Figure 2.3 Instrument Layout, AN/FO 2

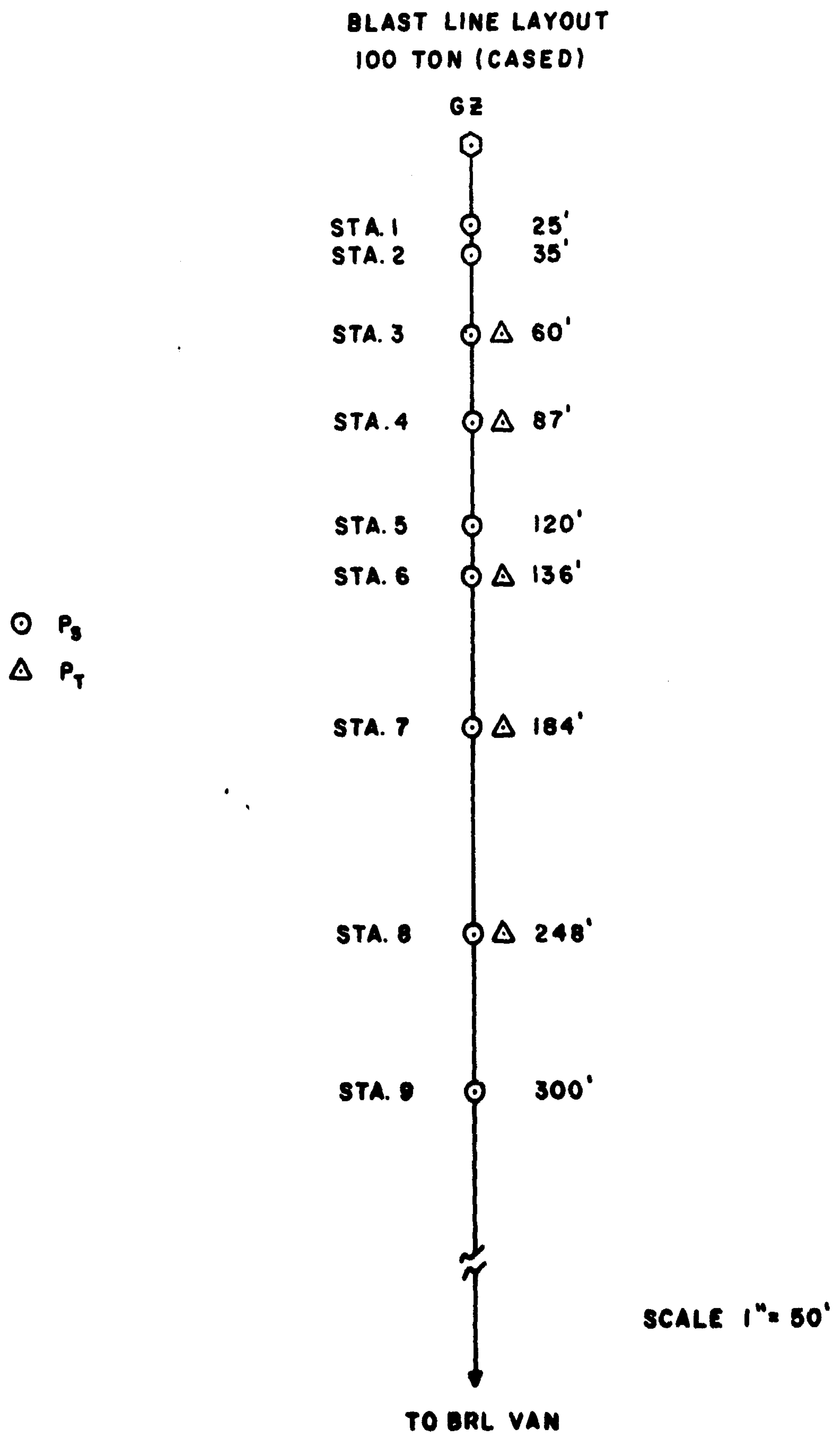

Figure 2.4 Instrument Layout, AN/FO 3

The signal conditioning equipment consists of B & F Instruments Inc. Model 30-100F power supplies and PC 2423 signal conditioning cards. These were used to supply gage excitation, bridge balancing, and remote shunt calibration. The single step remote shunt calibration was used only to detect system gain changes.

The Bell and Howell (CEC) Model 1-165 DC amplifiers were employed to amplify the transducer signal output to the required level of the FM record amplifiers. These amplifiers are high gain, differential input, DC amplifiers, with a DC to 20 KHz bandwith.

20 KHz wideband ($\pm$ 40 percent) FM record amplifiers were used with the CEC VR-3300 magnetic tape recorders. The recorders were standard 14 track, 1 inch tape transport machines and were operated at a tape speed of 60 ips and a center frequency of 108 KHz.

The recording equipment was housed in an instrumentation trailer 4000 feet from ground zero. In this position the trailer was able to serve two test programs; the AN/FO experiments and a second project known as the Height of Burst experiment, with reasonable cable runs. The systems were remotely operated by hardwire timing signals furnished by the DRES timing and firing installations.

Mounts for the pressure gages were recovered from previous experimental sites on the area and installed where required. The total head mounts used on Event 3 were fabricated and installed by an on site contractor.

Static calibration of the instrumentation was carried out in the field after installation of the equipment.

2.3 Method of Data Reduction

The reduction of the data was accomplished with the aid of the BRL analog to digital (A to D) conversion station and the Ballistic Research Laboratories Electronic Scientific Computer (BRLESC). The calibration and the data tapes were converted to digital form and the digital information was stored on magnetic tape for insertion into the computer.

Digitizing of the electronic and physical forcing functions was triggered manually. One block, consisting of 2000 samples, was taken for each calibration level. Each block was averaged to acquire a single value to be used as the calibration step. Pressure time histories were converted automatically with the digitizer triggered by the recorded detonation pulse. Time was accumulated from that point for the purpose of determining the shock wave arrival time. Digital information was again accumulated in blocks; the number of blocks of information stored for any particular time history was predetermined on the basis of the positive phase duration and the arrival time of the record. A 100 KHz sampling rate was used. The digital information was then converted to engineering units using the BRLESC. The information obtained by applying the calibration values to the data was corrected by the ratio of the two electrical calibration values taken during the static calibration and immediately before the detonation. This ratio corrected for any gain change in the recording system.

3. RESULTS

3.1 General

The detonation of the three events was successfully carried out on schedule. The ability to emplace and fire these events in three weeks time was demonstrated.

Presented in Figures 3.1 through 3.3 are photographs of each of the three detonations. The presence of jets that precede the shock front are seen in AN/FO 2 and 3, (Figures 3.2 and 3.3). There were no jets of this type observed on AN/FO 1. Typical of the AN/FO detonations is the absence of an extended fireball so common to TNT explosions. A balanced oxygen system in the AN/FO material results in little or no afterburning and consequently no resultant carbon residue.

The environmental conditions prevailing at the time of detonation for each event are presented in Table 3.1. The instrumentation system functioned well as programmed. The electronics performed with good fidelity. Transducers positioned at the close-in station (Station 1)

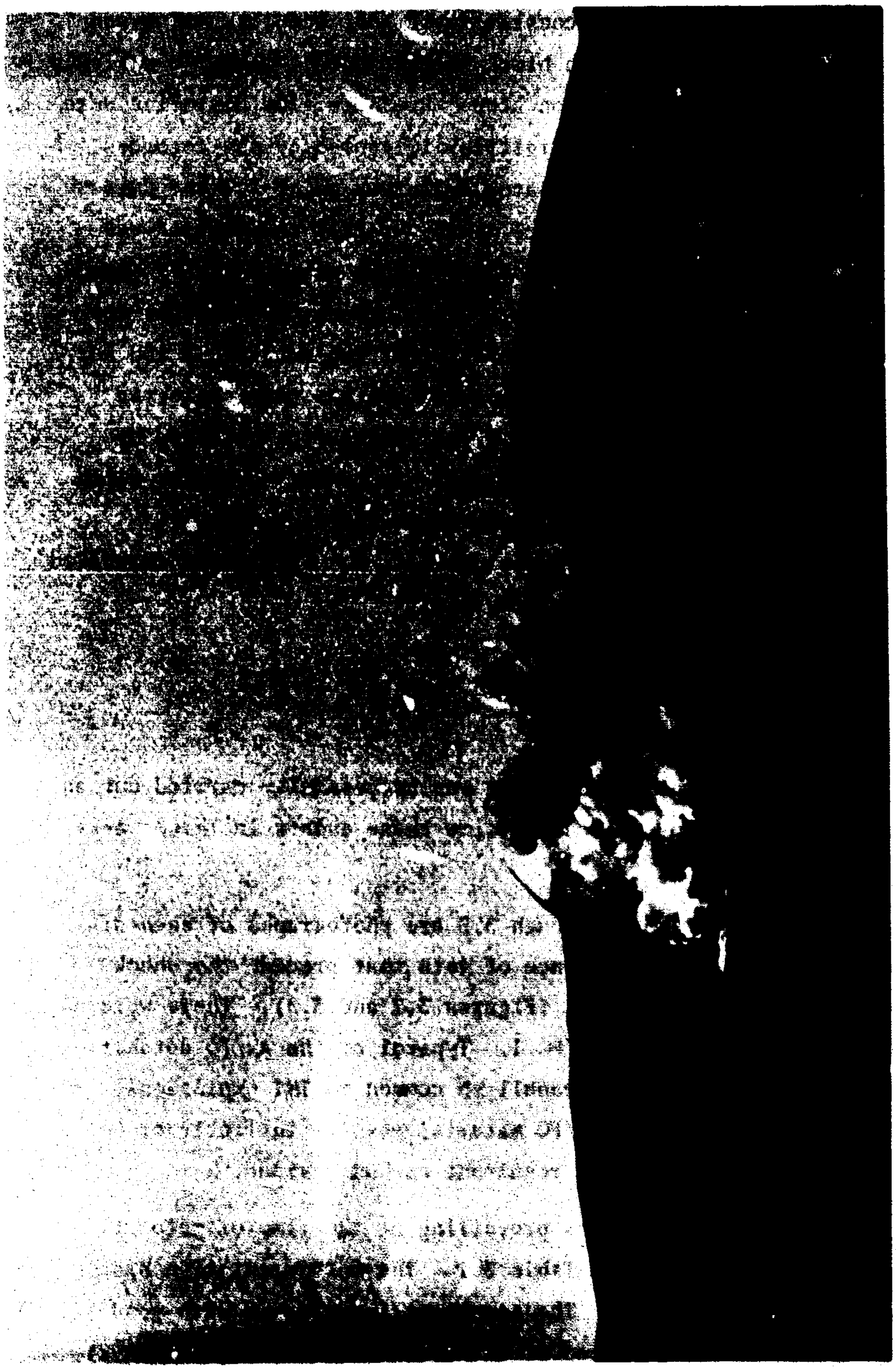

Figure 3.1 Detonation of AN/FO 1

Figure 3.2 Detonation of AN/FO 2

Figure 3.3 Detonation of AN/FO 3

Table 3.1 Environmental Conditions

	AN/FO 1	AN/FO 2	AN/FO 3
Firing Time	1100 Hours 14 Aug 69	1100 Hours 21 Aug 69	1100 Hours 28 Aug 69
Charge Weight	20 Ton Bagged	19 Ton Cased	100 Ton Cased
Ambient Pressure	13.579 psi	13.565 psi	13.533 psi
Temperature:			
Surface	104.0°F	110.2°F	94.6°F
1 Meter	84.8°F	92.8°F	65.5°F
Wind Velocity:			
1/2 Meter	5.4 mph at 180°	7.9 mph at 235°	5.2 mph at 315°
2 Meters	6.2 mph at 180°	10.8 mph at 235°	9.3 mph at 315°
8 Meters	10.1 mph at 175°	14.2 mph at 240°	13.2 mph at 310°
Relative Humidity	35%	21%	62%
Sunshine	Bright	Bright	Bright
Surface Condition	Dry	Dry	Dry

were encompassed by a very severe environment as indicated by the record from Station 1, Event 3. Some question exists as to the validity of the peak pressure of all station 1 records. It is possible that the true peak has not been recorded due to the frequency response limitation (20 KHz) of the recording system. This indicates that a larger degree of error than the normal 5% is associated with these records. Some total head sensors on Event 3 were severely affected by the anomalous waves and the severe environment.

The computed data output is available in three forms: (1) tabular listings, (2) time-pressure plots, and (3) stored data on magnetic tapes. The listings and plots are visual displays and can be used directly for data examination, evaluation, and presentation.

3.2 Presentation of Data

Air blast data for the three events are listed in Tables 3.2 through 3.5. Arrival time, maximum overpressure, positive phase duration and overpressure impulse are shown plotted versus ground range in Figures 3.4 through 3.7 for Events 1 and 2. Similar parameters are presented in Figures 3.8 through 3.12 for Event 3. Pressure time plots of the data are presented in the appendix.

A log log polynomial fit has been carried out for the pressure data using the BRL Multiple Regression Program (Reference 4). The following equations apply:

$$\text{Event 1} \quad \ln P_n = \left[7.5895 - .029335 (\ln D)^3\right]$$

$$\text{Event 2} \quad \ln P_n = \left[7.3471 - .027137 (\ln D)^3\right]$$

$$\text{Event 3} \quad \ln P_n = \left[7.6728 - .0040638 (\ln D)^3\right]$$

where P_n = overpressure

D = Ground Range.

Table 3.2 Instrumentation Results, AN/FO, 1

Station No.	Ground Range (ft)	System-Channel	Time of Arrival (msec)	Maximum Over-Pressure (psi)	Positive Phase Duration (msec)	Over-Pressure Impulse (psi-msec)	Remarks
1	15	1-2	1.75	866	3.7	1357	Questionable peak pressure.
2	20	2-2	2.2	1125	5.3	1020	Good record.
3	35	3-2	3.9	590	6.5	623	Good record.
4	51	1-3	6.4	291	7.0	446	Good record.
5	80	2-3	12.4	188	10.6	496	Good record.
6	110	3-3	20.2	88	25.5	472	Good record.
7	148.5	1-4	34.6	50	30.3	396	Good record.

Table 3.3 Instrumentation Results, AN/FO 2

Station No.	Ground Range (ft)	System-Channel	Time of Arrival (msec)	Maximum Over-Pressure (psi)	Positive Phase Duration (msec)	Over-pressure Impulse (psi-msec)	Remarks
1	15	2-4	2.0	879	4.0	1580	Questionable peak pressure.
2	20	3-4	2.4	796	6.0	914	Good record.
3	35	1-5	4.2	413	13.7	720	Questionable duration.
4	51	2-5	6.4	296	6.6	484	Good record.
5	80	2-3	12.4	189	13.2	559	Good record.
6	106	3-3	19.6	90	23.2	482	Good record.
7	144	1-4	33.2	52	29.1	391	Good record.

Table 3.4 Instrumentation Results, AN/FO 3

Station No.	Ground Range (ft)	System-Channel	Time of Arrival (msec)	Maximum Over-Pressure (psi)	Positive Phase Duration (msec)	Over-pressure Impulse- (psi-msec)	Remarks
1	25	3-5	3.0	1260	-	-	Poor record.
2	35	1-6	3.8	1222	13.9	1256	Good record.
3	60	2-6	6.4	752	10.2	850	Good record.
4	87	1-9	10.0	373	9.2	922	Good record.
5	120	3-9	15.9	273	12.6	882	Good record.
6	136	1-10	19.4	217	30.9	871	Good record.
7	184	3-10	32.0	96.1	38.9	802	Good record.
8	249	2-11	58.0	47.3	54.5	669	Good record.
9	300	1-12	83.4	31.0	64.1	589	Good record.

Table 3.5 Instrumentation Results, Dynamic Pressure, AN/FO 3

Station No.	Ground Range (ft)	System-Channel	Time of Arrival (msec)	Maximum Over-Pressure (psi)	Dynamic Pressure Impulse (psi-msec)	Remarks
3	60	2-6 3-6	6.4	-	-	Poor total head record.
4	87	1-9 2-9	9.8	705	-	Questionable total head record.
6	136	1-10 2-10	19.0	130	-	Good records.
7	184	3-10 1-11	32.0	100	276	Good records.
8	249	2-11 3-11	58.0	45.7	328	Good records.

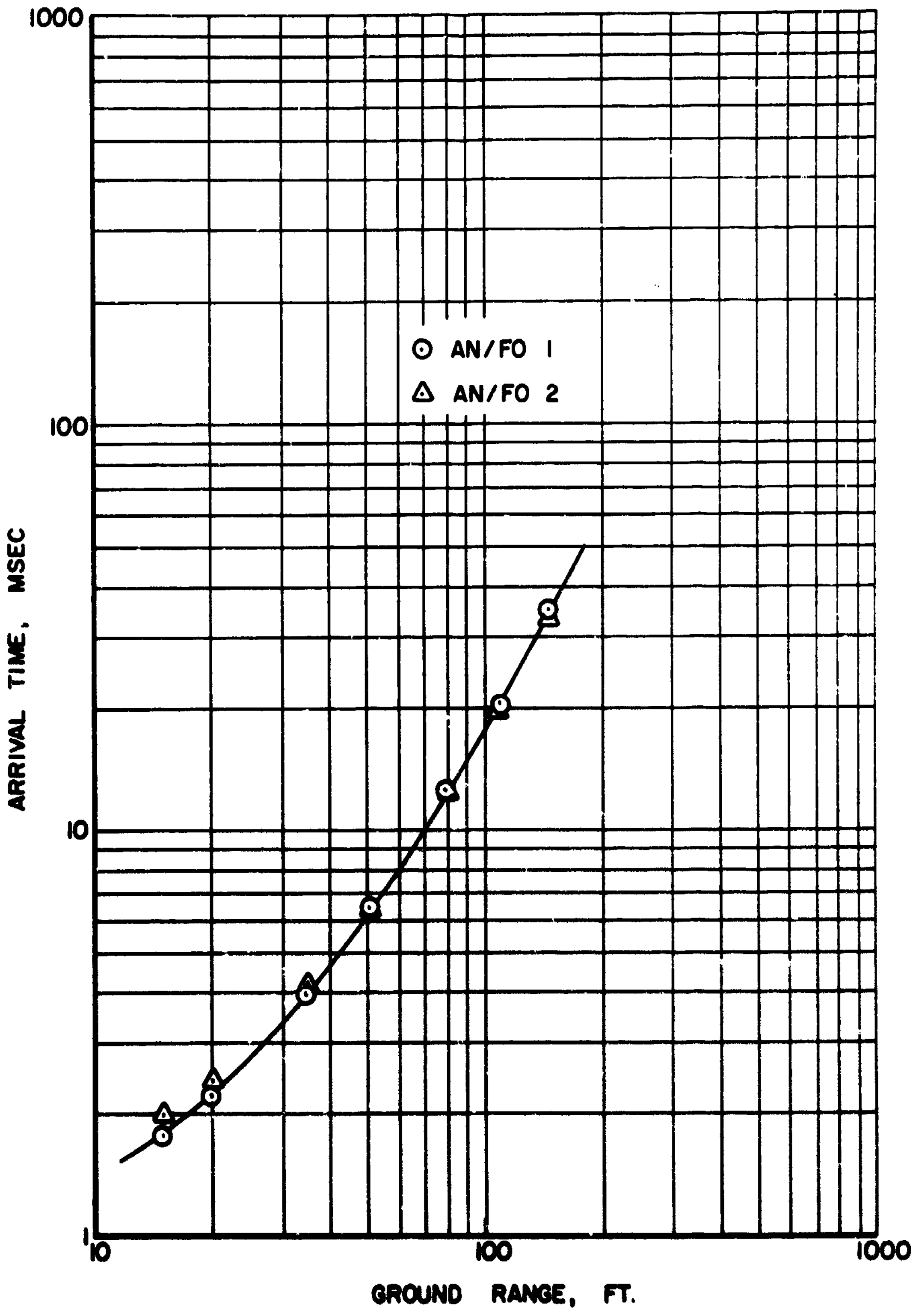

Figure 3.4 Arrival Time versus Ground Range, AN/FO 1 and 2

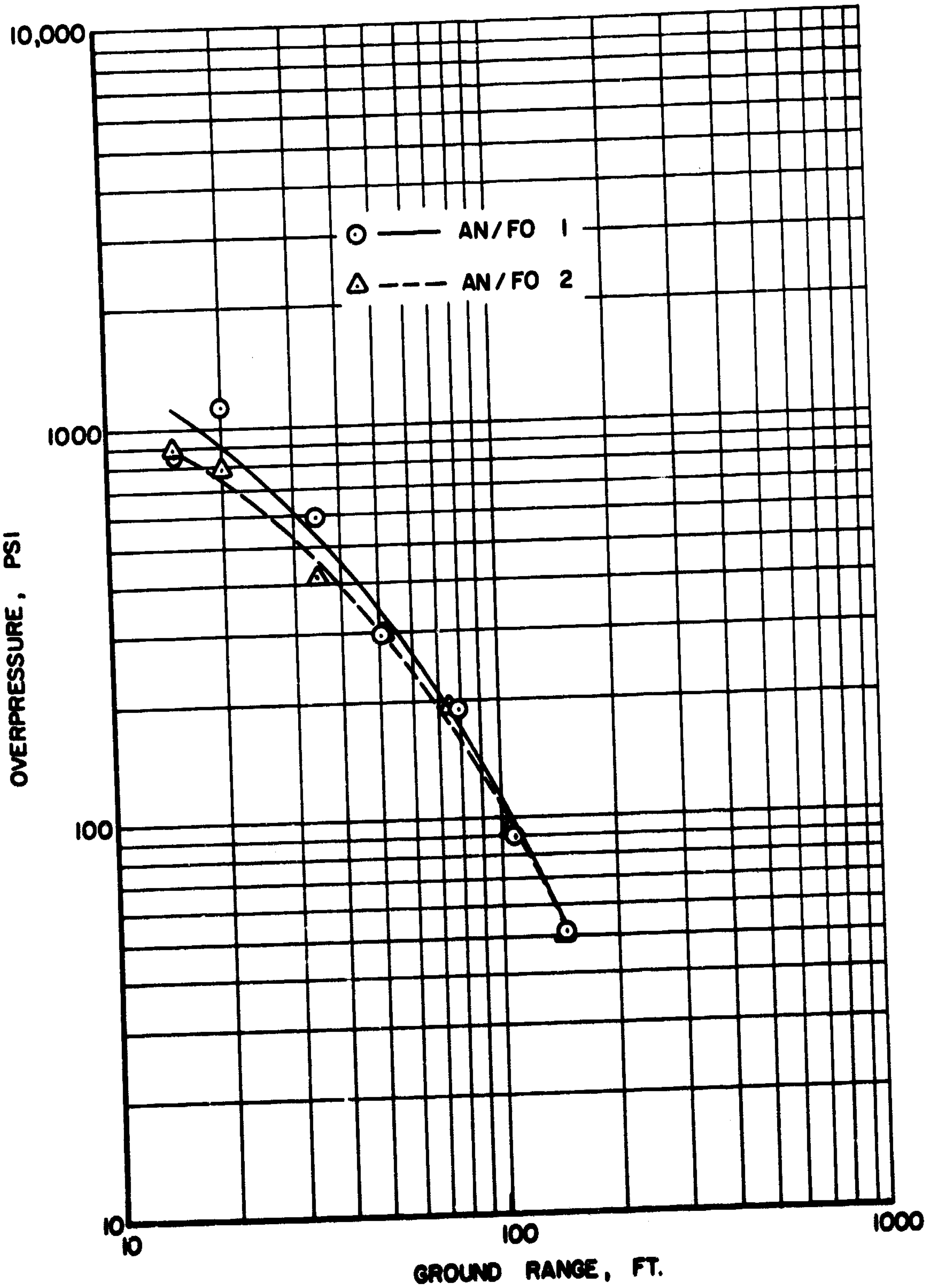

Figure 3.5 Maximum Overpressure versus Ground Range, AN/FO 1 and 2

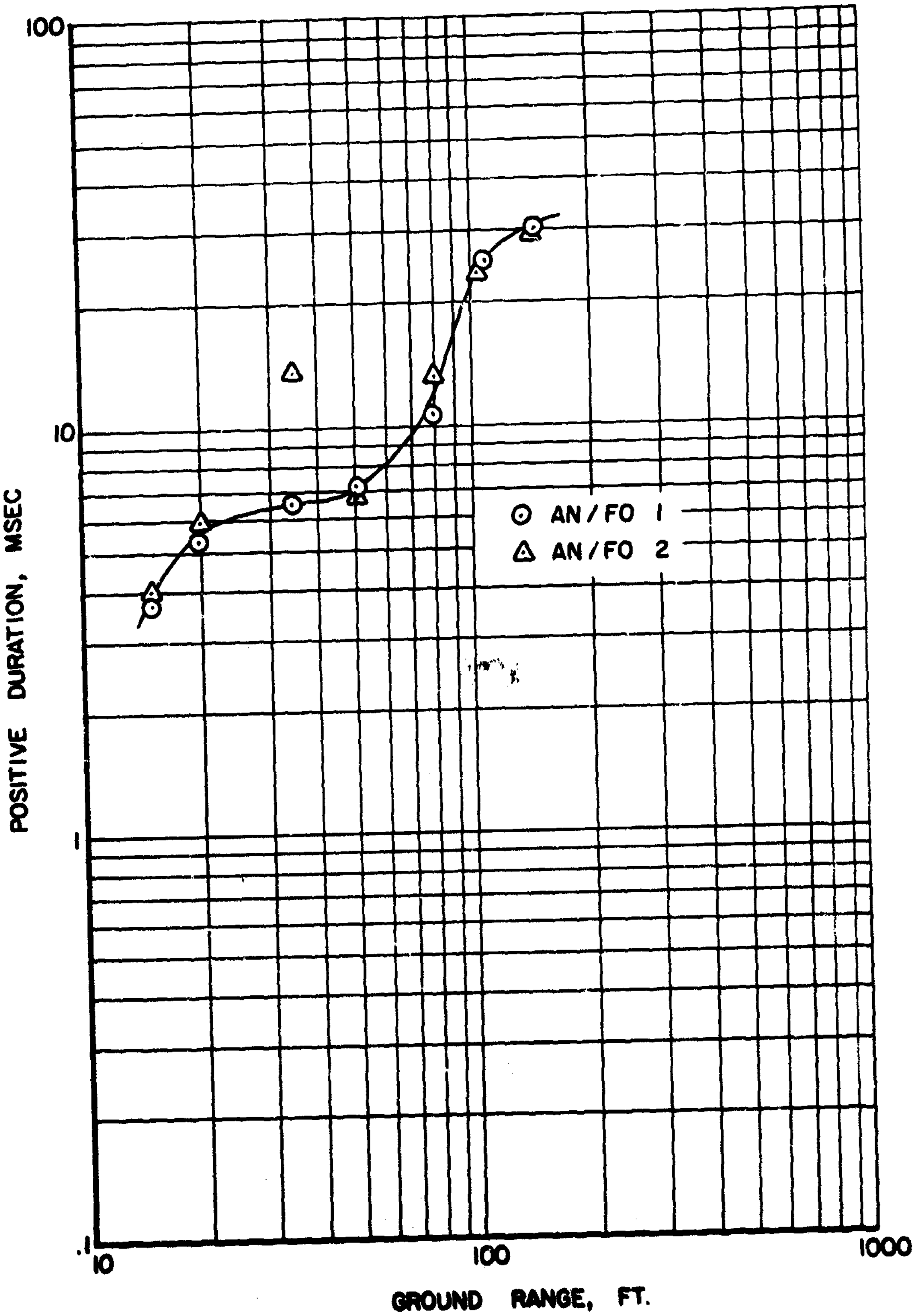

Figure 3.6 Positive Phase Duration versus Ground Range, AN/FO 1 and 2

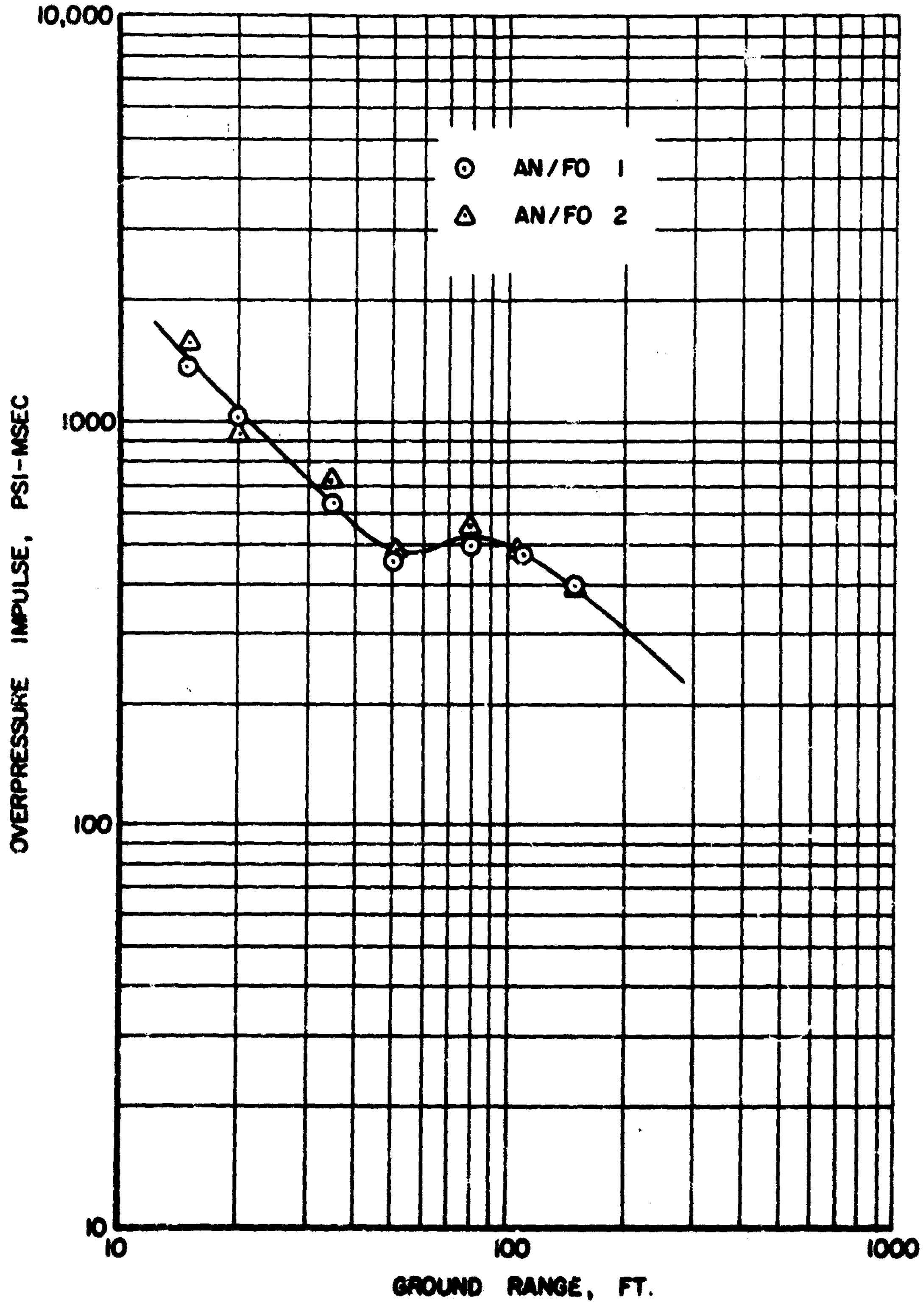

Figure 3.7 Positive Overpressure Impulse versus Ground Range, AN/FO 1 and 2

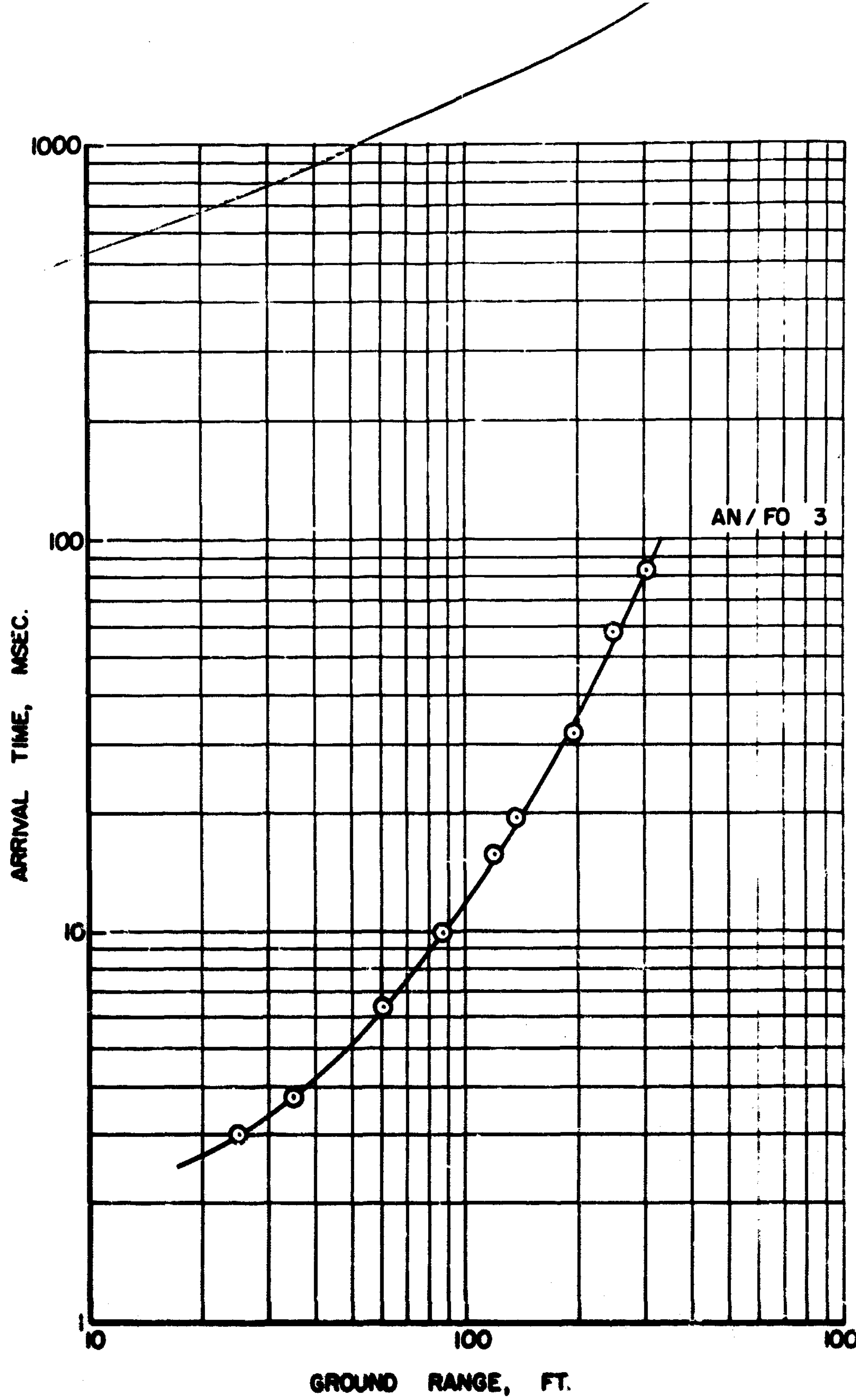

Figure 3.8 Arrival Time versus Ground Range, AN/FO 3

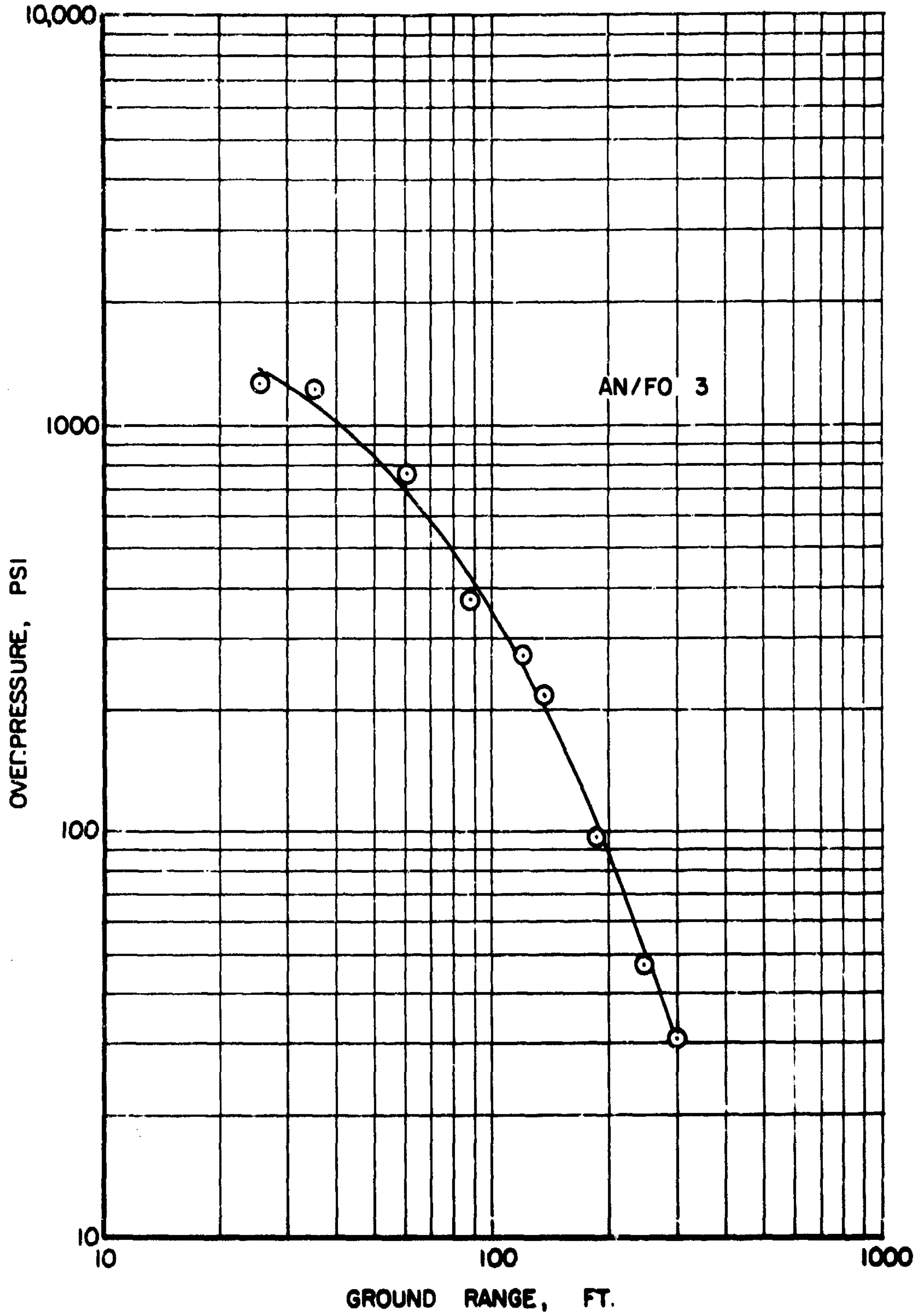

Figure 3.9 Maximum Overpressure versus Ground Range, AN/FO 3

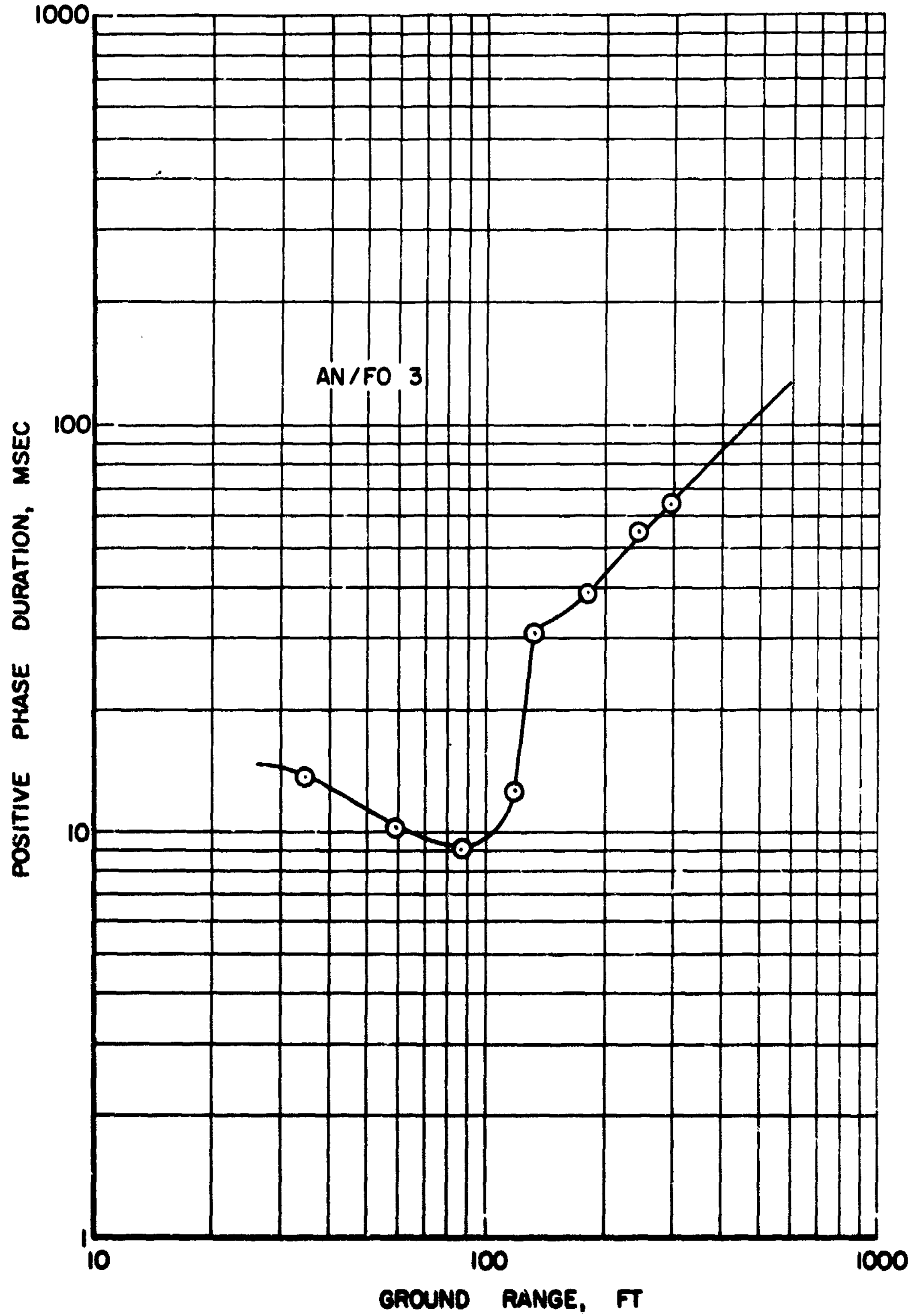

Figure 3.10 Positive Phase Duration versus Ground Range, AN/FO 3

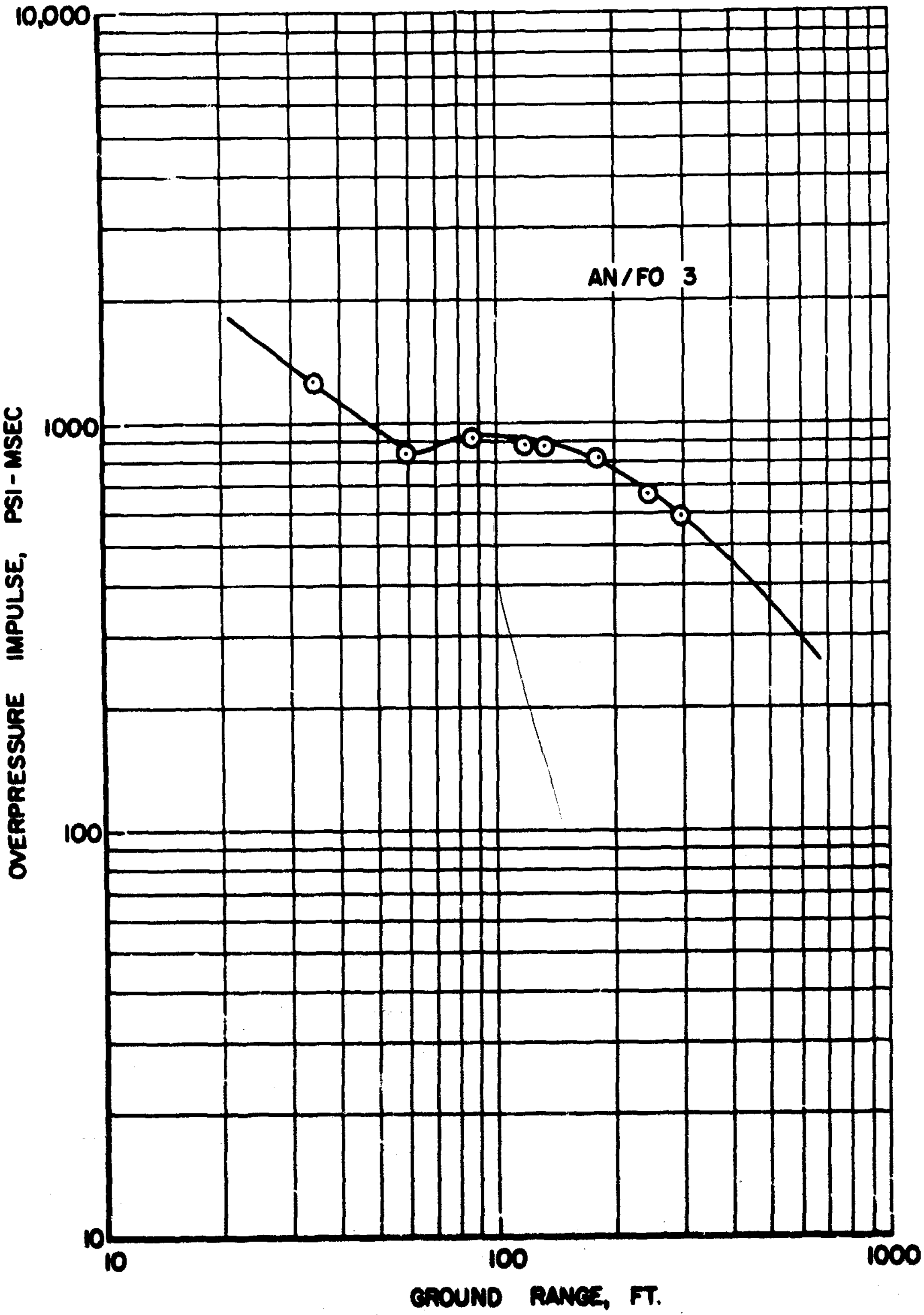

Figure 3.11 Positive Overpressure Impulse versus Ground Range, AN/FO 3

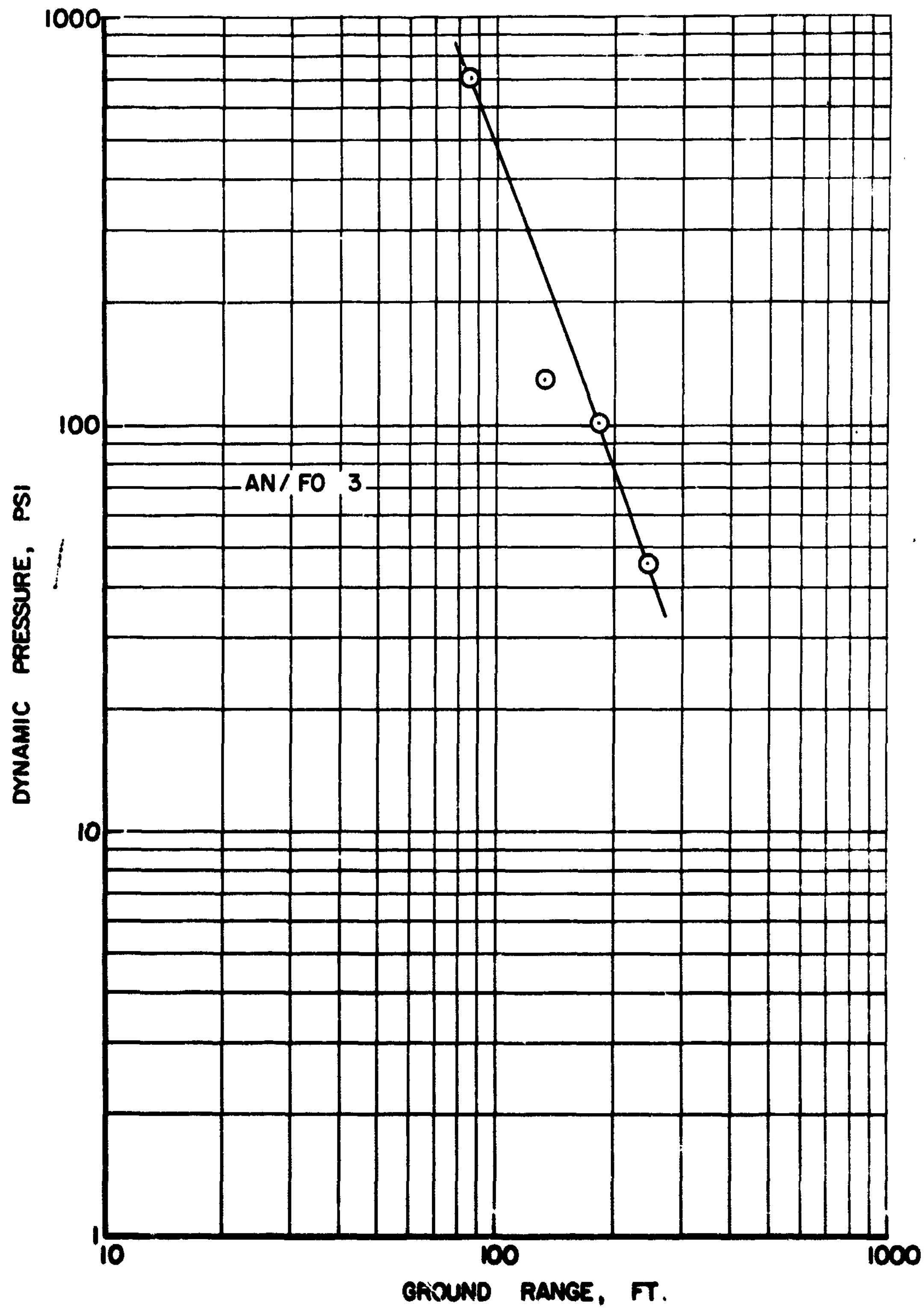

Figure 3.12 Maximum Dynamic Pressure versus Ground Range, AN/FO 3

The curves drawn through the data points in the graphs represent visual fit, unless otherwise identified.

Wave forms of Event 1 were classical in nature, generally, except Station 6 (110 ft). It is believed the wave form at this station was affected by the presence of the line of Canadian ABTOAD gages which crossed in front of the gage location. At Station 4, (51 ft) Event 2, an anomalous wave form was recorded. Event 3 records reveal anomalous behavior from Stations 4 through the end of the blast line (87 ft through 300 ft). The presence of jets from the fireball influenced the majority of the records.

Dynamic pressure data, which requires subtracting side-on records from the equivalent total head records, was very difficult to obtain due to the quality of the records. Peak dynamic pressure was the only parameter worthy of presentation. It is presented in Figure 3.12 with a TNT curve. The time history data may be found in the appendix.

4. GENERAL DISCUSSION

4.1 Comparison of Events 1 and 2

The bagged AN/FO shot, AN/FO 1, was free of any jets that preceded the shock front. AN/FO 2, on the other hand, produced jetting that may have influenced the waveshape of the pressure time records. A look at the various parameters as seen plotted versus ground range in Figures 3.4 through 3.7 show with few exceptions a comparable blast output. However, major differences are evident in the overpressure at 20 and 35 feet and in the positive phase duration at 35 feet. The long duration of Event 2, 35 feet, may have resulted from a zero shift, transducer malfunction, or recording problems. No logical reason can be offered for the differences in the overpressure.

4.2 Comparison with TNT

In order to compare with the empirical TNT data from hemispherical surface bursts as presented in Reference 6, the various parameters were scaled to 1 lb, sea level conditions. The scaling factors derived from the standard scaling relationships (see Reference 6) are as follows:

	AN/FO No. 1	AN/FO No. 2	AN/FO No. 3
S_p	1.082	1.083	1.086
S_d	0.02848	0.02896	0.01663
S_t	0.02918	0.02989	0.01674
S_I	0.03158	0.03239	0.01818

where: S_p = scaling factor for pressure

S_d = scaling factor for distance

S_t = scaling factor for time

S_I = scaling factor for impulse.

Tables 4.1 through 4.3 present tabulations of the scaled data. Plots of the parameters versus ground range are presented in Figures 4.1 through 4.4. The dashed curves in Figure 4.2 represents the best fit to the data according to the following equation:

$$\ln P_n = 6.3717 - 1.1349\ (\ln D) - 0.25937\ (\ln D)^3$$

where P_n = overpressure

D = distance.

The dashed curve in the remaining graphs, Figures 4.2 through 4.4 was developed by an visual fit to the data.

The data in the close-in region for all parameters shows considerable scatter. Arrival times of the AN/FO events are much longer than TNT from the very high pressure region through 200 psi. It is probable that the longer burning time of the AN/FO explosive produced this effect.

Table 4.1 Scaled Overpressure Data, AN/FO 1

Station No.	Ground Range (ft)	Arrival Time (msec)	Overpressure (psi)	Positive Duration (msec)	Positive Impulse (psi-msec)
1	.427	.051	--	--	
2	.570	.064	1217	.155	32.21
3	.997	.114	638	.190	19.67
4	1.452	.187	315	.204	14.09
5	2.28	.362	203	.309	15.66
6	3.13	.589	95	.744	14.91
7	4.23	1.01	54.2	.884	12.52

Table 4.2 Scaled Overpressure Data, AN/FO 2

Station No.	Ground Range (ft)	Arrival Time (msec)	Overpressure (psi)	Positive Duration (msec)	Positive Impulse (psi-msec)
1	.434	.060	--	--	
2	.579	.072	862	.179	29.6
3	1.01	.125	447	.41*	23.32
4	1.48	.191	321	.198	15.67
5	2.32	.370	205	.395	18.11
6	3.26	.586	97.5	.693	15.61
7	4.41	.992	56.3	.870	12.66

*Data point questioned and not plotted.

Table 4.3 Scaled Overpressure Data, AN/FO 3

Station No.	Ground Range (ft)	Arrival Time (msec)	Overpressure (psi)	Positive Duration (msec)	Positive Impulse (psi-msec)
1	.416	.0502	1368*	--	--
2	.58	.064	1327	.233	22.83
3	.998	.011	817	.171	15.45
4	1.45	.167	405	.154	16.76
5	1.99	.266	296	.211	16.03
6	2.26	.325	236	.517	15.84
7	3.06	.536	104.4	.651	14.58
8	4.14	.971	51.4	.912	12.16
9	4.99	1.396	33.7	1.07	10.71

*Data point questioned and not plotted.

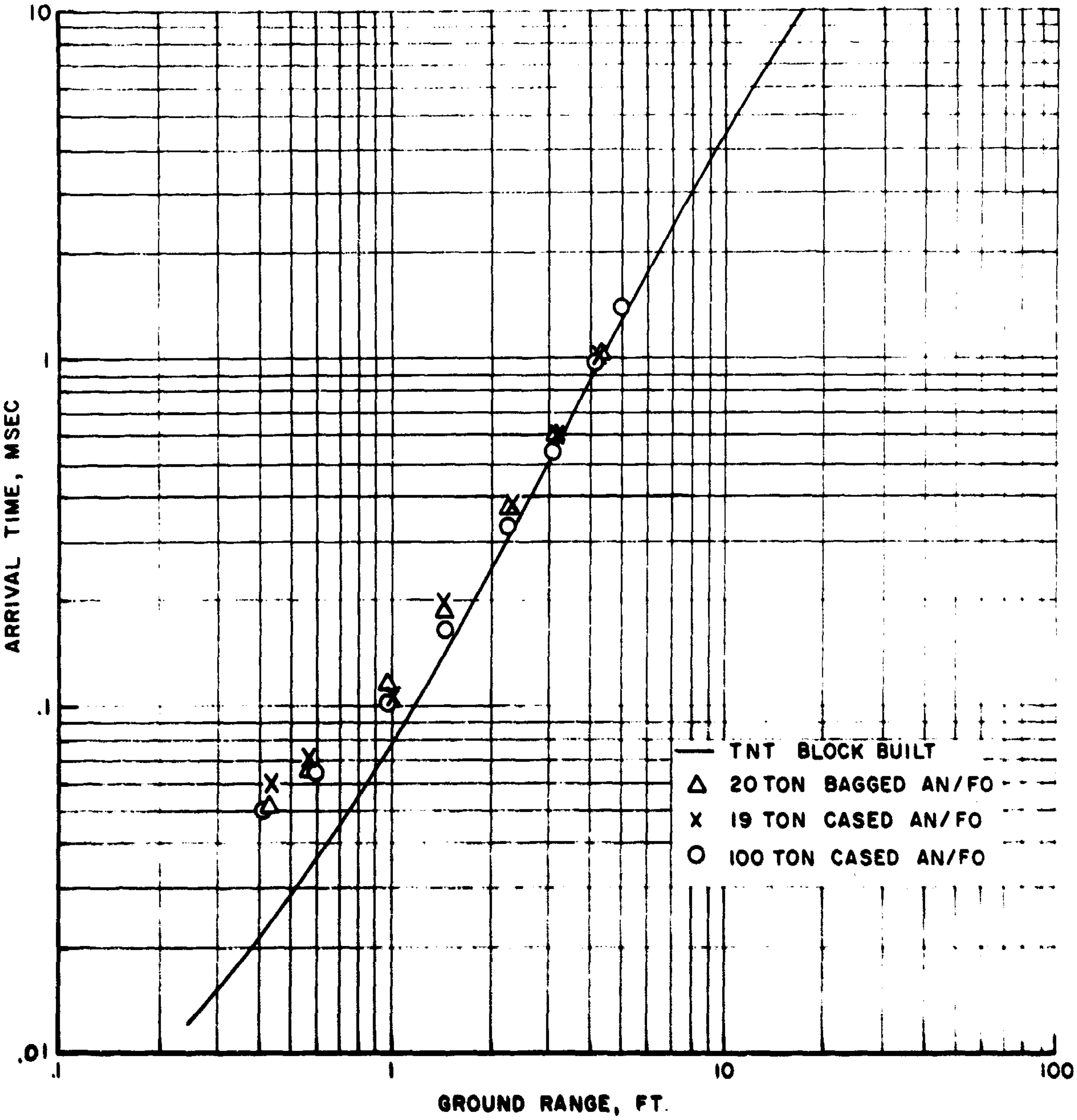

Figure 4.1 AN/FO Arrival Time Data Compared with TNT (Scaled to 1 lb. Sea Level)

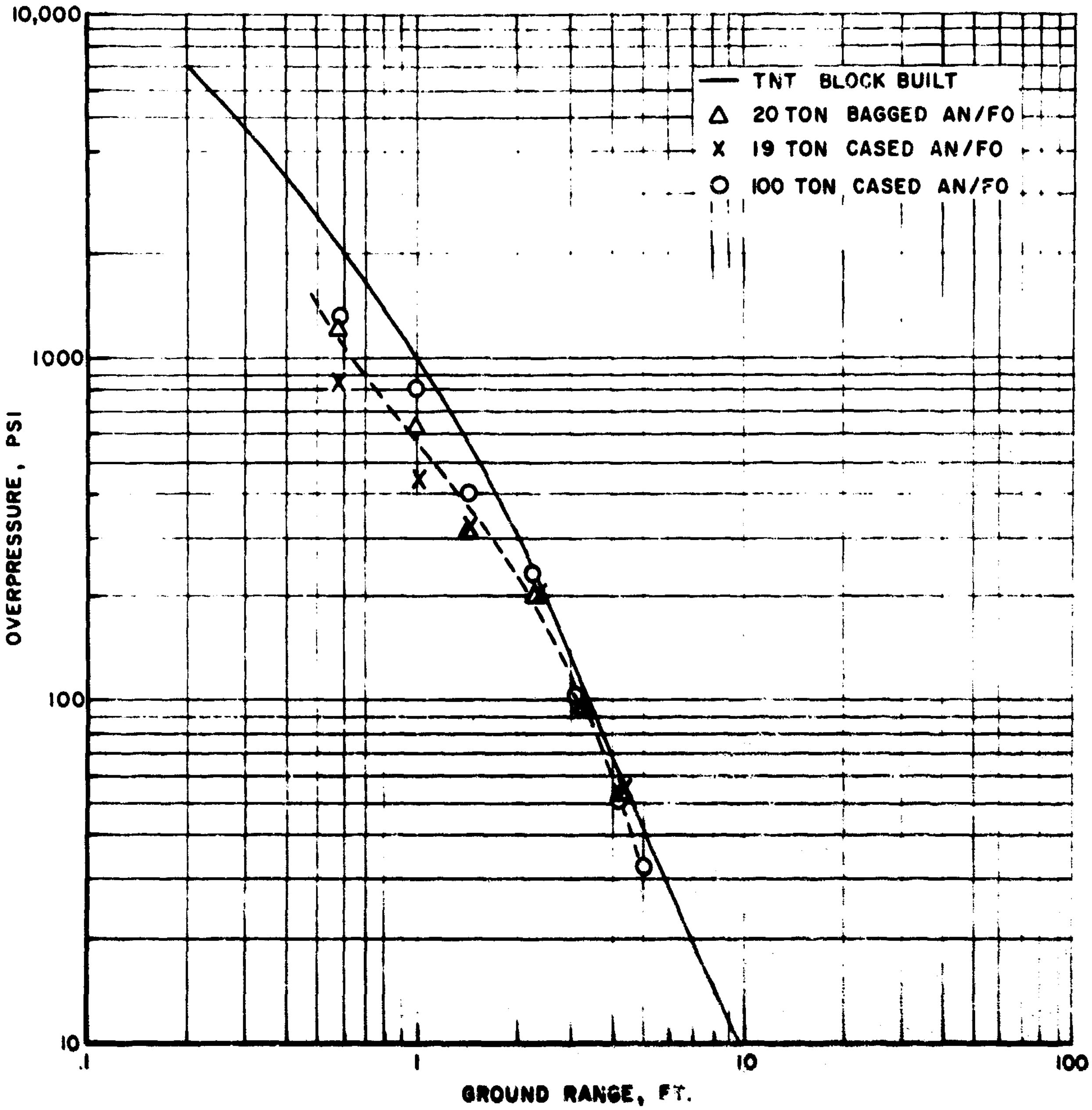

Figure 4.2 AN/FO Overpressure Data Compared with TNT (Scaled to 1 lb, Sea Level)

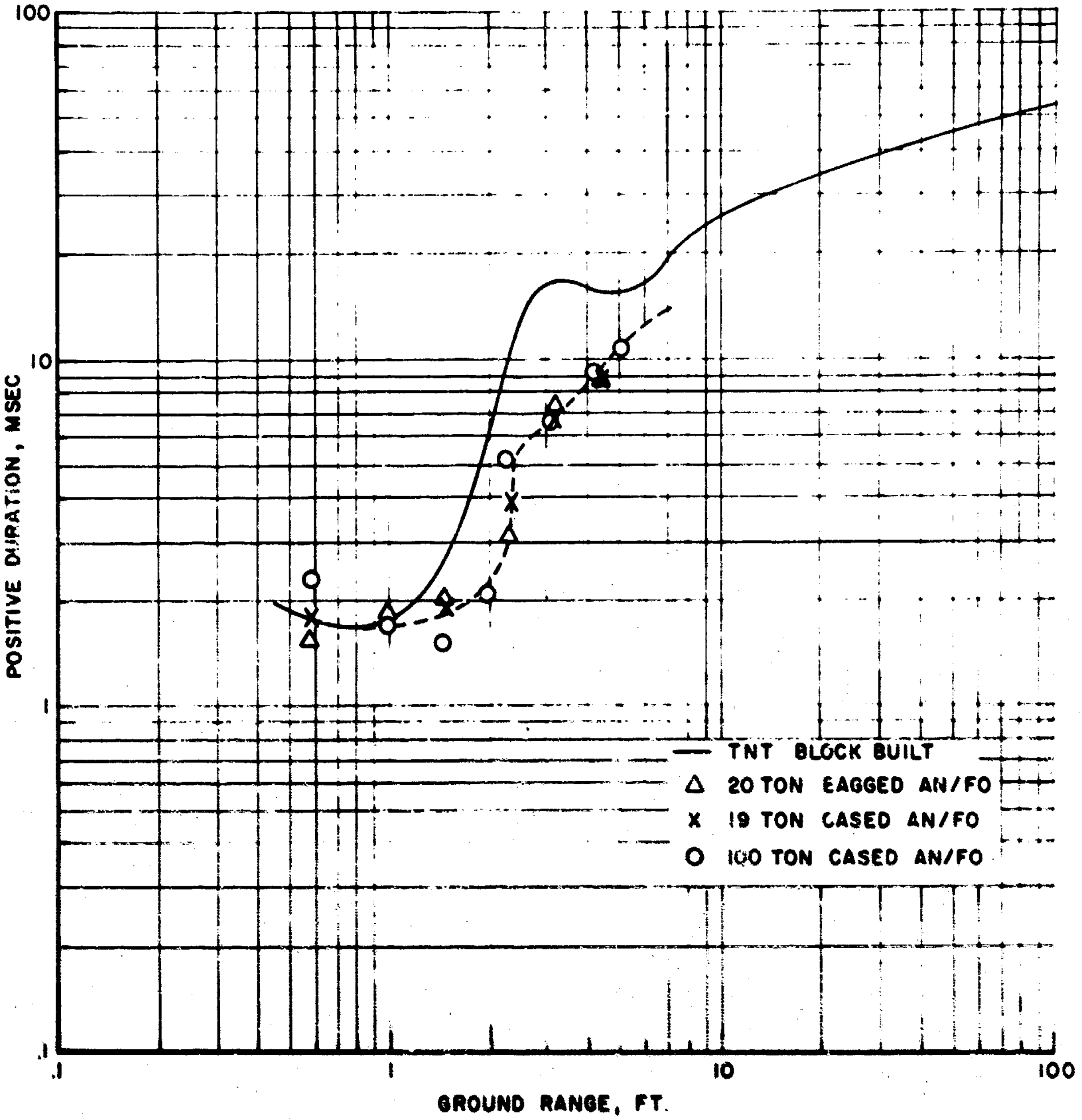

Figure 4.3 AN/FO Positive phase Duration Data (Scaled to 1 lb. Sea Level)

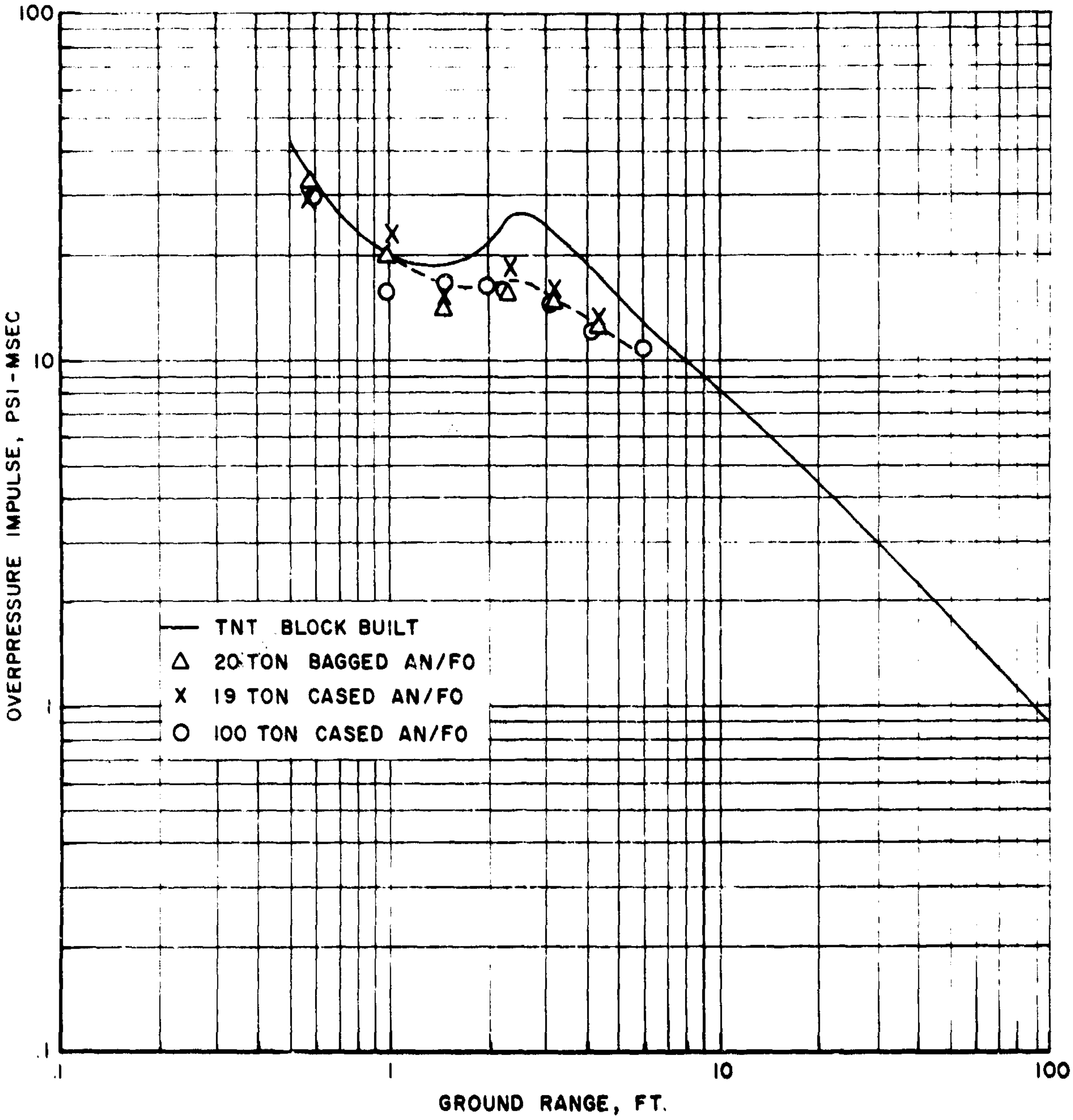

Figure 4.4 AN/FO Overpressure Impulse Data (Scaled to 1 lb. Sea Level)

Overpressure measurements over the range of 200 to 30 psi create a curve approximately parallel to that of TNT (dashed curve, Figure 4.2). With this curve as a basis, an average equivalence of 0.83 was determined. This result is consistent with the NOL results from small charges. Above 200 psi, the TNT equivalence is 0.59 increasing to 0.83 at 200 psi.

Duration and impulse comparison with TNT indicate close agreement in the high pressure region. Below 200 psi, the values are considerably less than the TNT. Examination of the impulse data only, indicates a 0.70 equivalence to that of TNT.

The limited dynamic pressure data when compared with TNT, Figure 3.12, tends to follow the pattern established by the overpressure parameter. The erratic pressure time wave forms suggest the exercise of caution when using this data.

5. CONCLUSIONS

A high order explosion was produced by the detonation of the AN/FO mixture. Jetting action was observed on two of the shots. The air blast was successfully recorded over the 1260 to 30 psi range. Comparison made with the TNT data show a 0.83 TNT overpressure equivalence over the 200 to 30 psi range; for impulse, the data shows an equivalence of 0.70.

Dynamic pressure parameters were not successfully obtained. Distorted wave forms created unsurmountable problems when subtracting side-on records from the total head records in the data reduction.

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APPENDIX

PRESSURE RECORDS, AN/FO 1, 2 AND 3

The caption associated with each pressure record contains the distance, the station number, and the event number indicated by the first digit following the station number and the system and channel number following the event number. In the case of the dynamic pressure, the following information identifies the notations:

P_T - total head pressure, psi

P_S - side-on pressure, psi

P_{DC} - corrected dynamic pressure, psi

Mach - Mach number

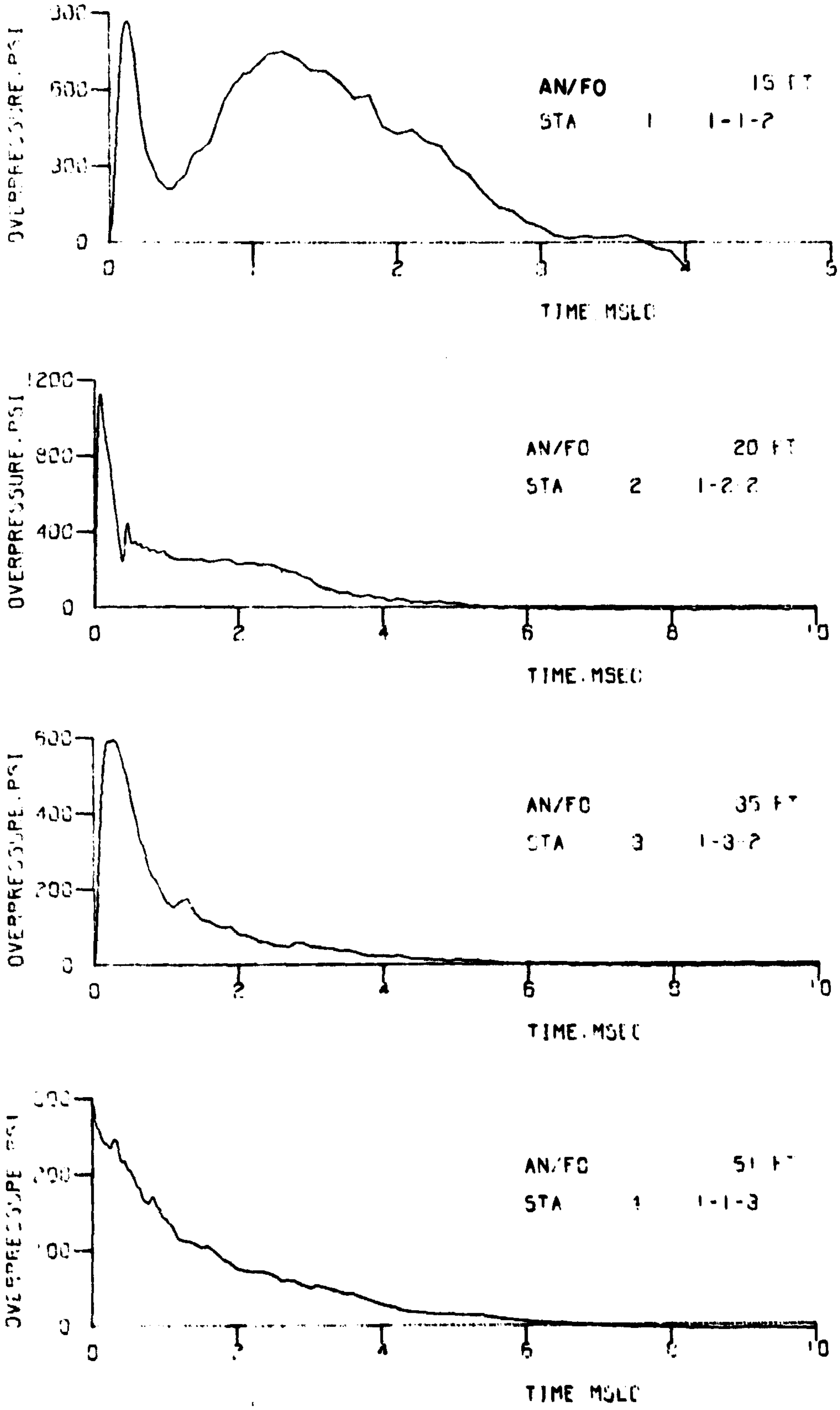

Figure A.1 Overpressure-Time Records, Stations 1-4, AN/FO 1

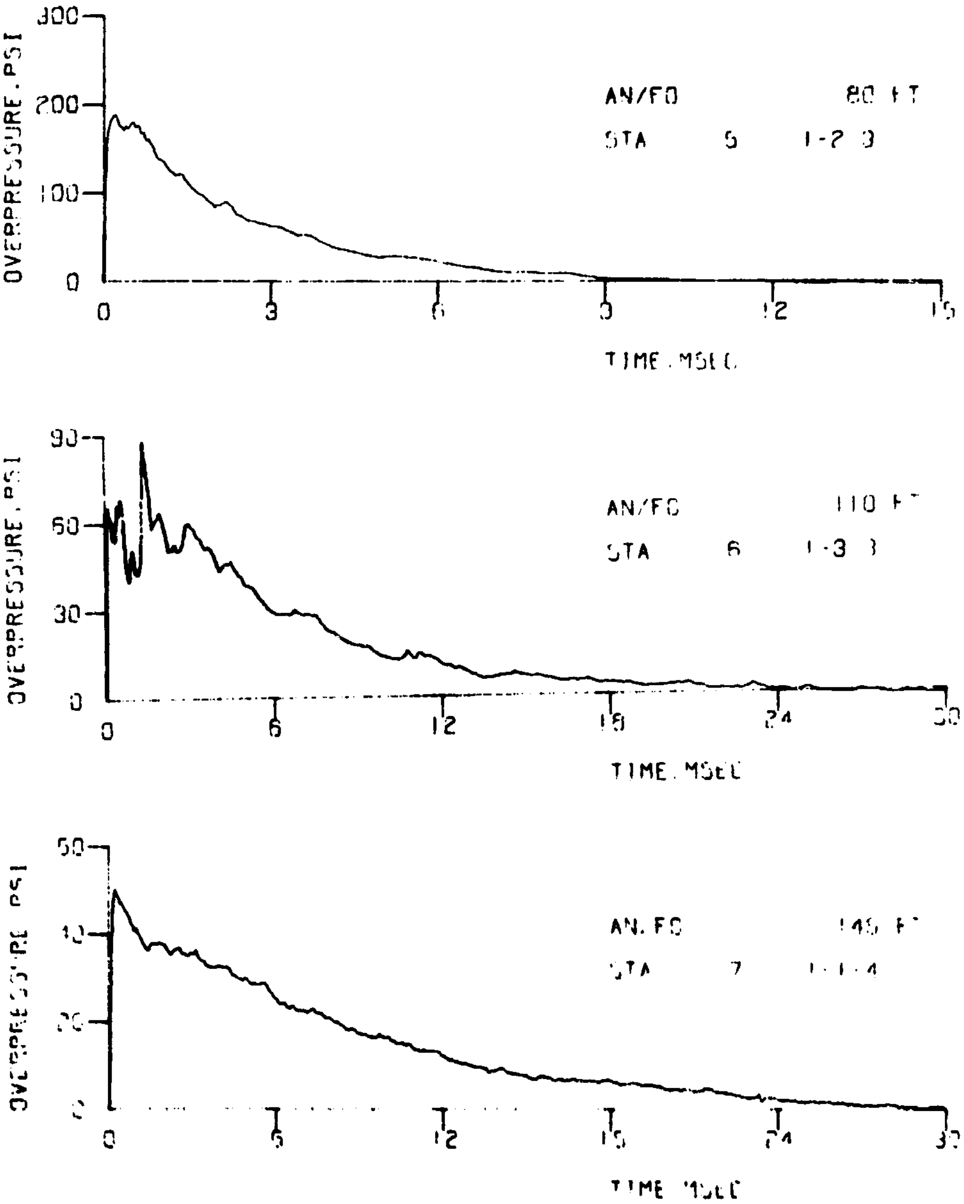

Figure A.2 Overpressure-Time Records, Stations 5-7, AN/FO 1

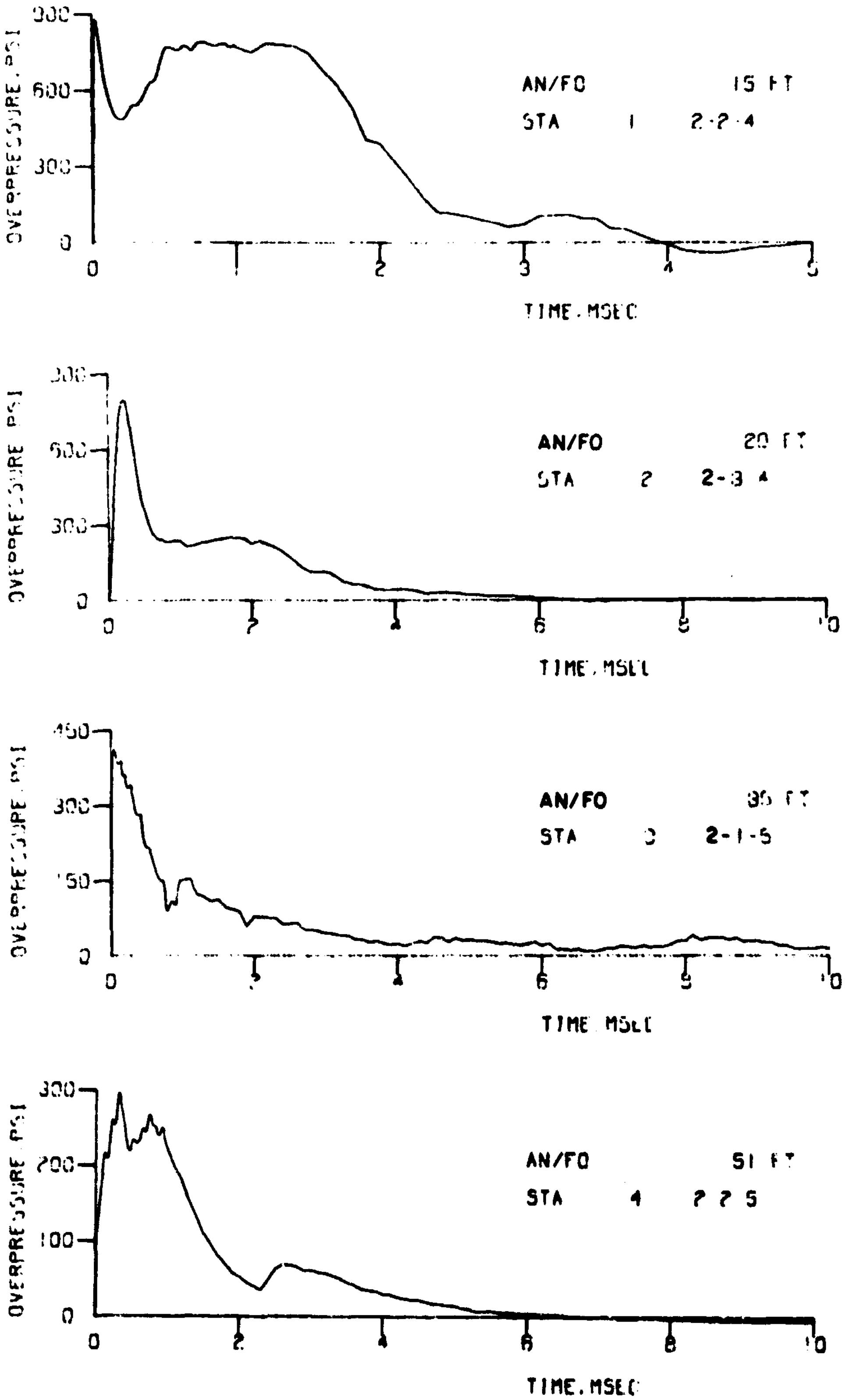

Figure A.3 Overpressure-Time Records, Stations 1-4, AN/FO 2

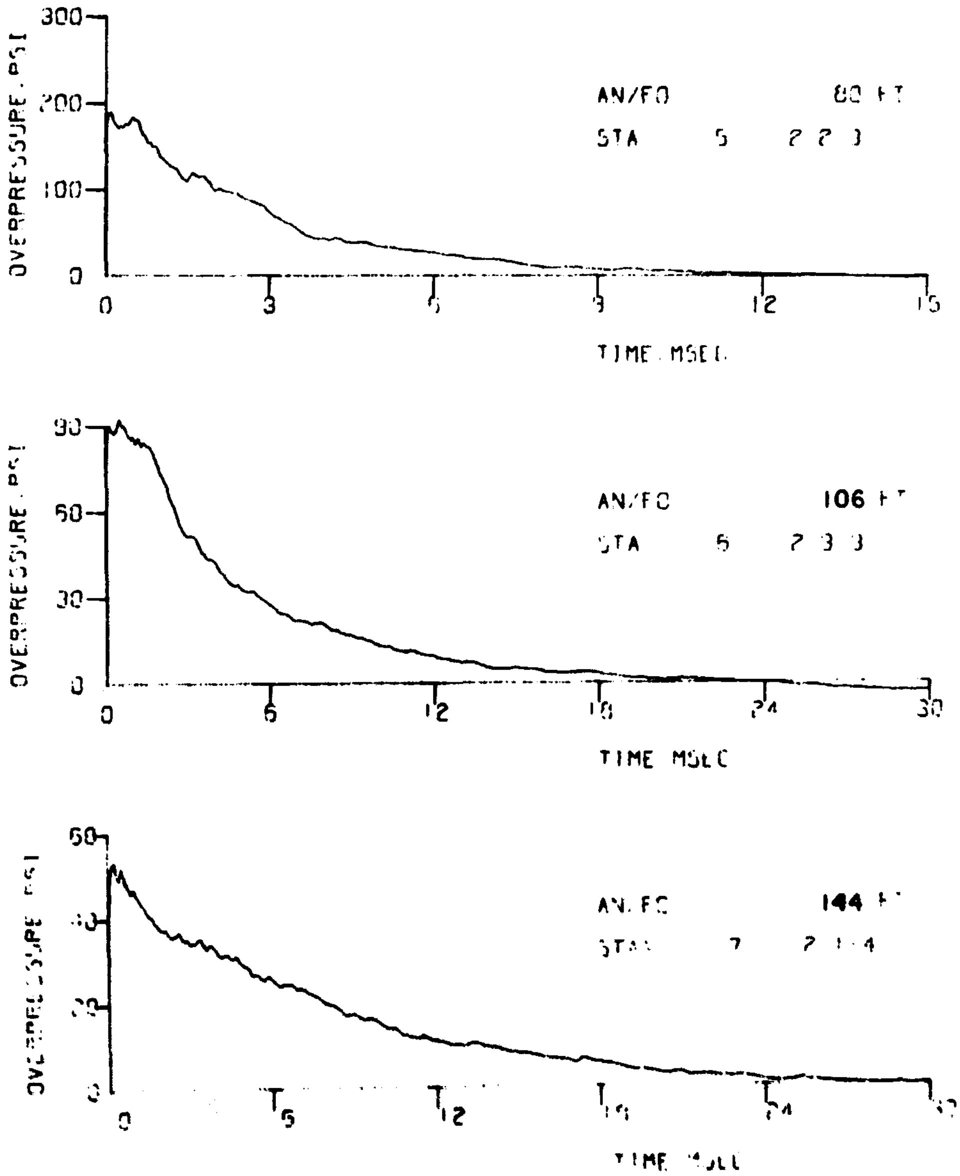

Figure A.4 Overpressure-Time Records, Stations 5-7, AN/FO 2

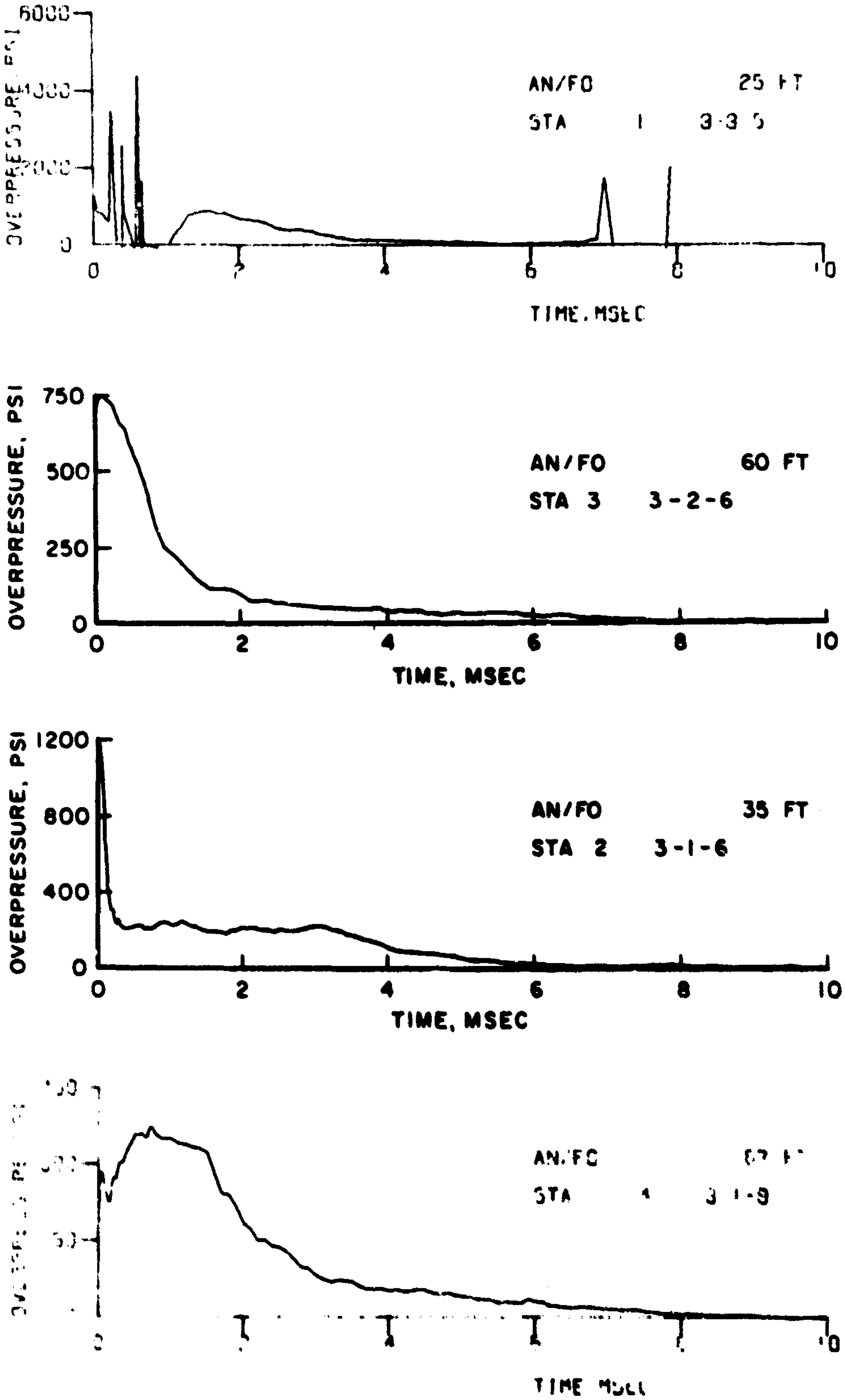

Figure A.5 Overpressure-Time Records, Stations 1-4, AN/FO 3

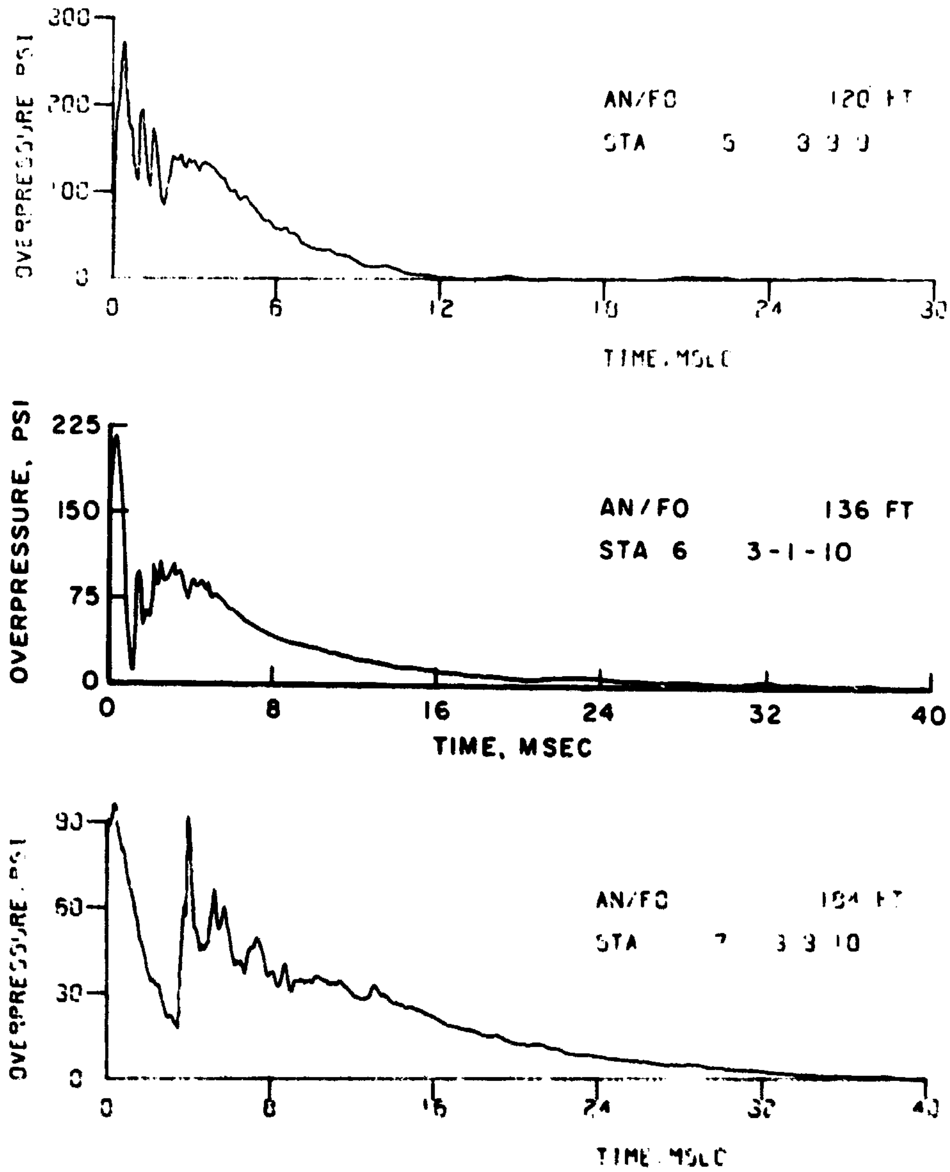

Figure A.6 Overpressure-Time Records, Stations 5-7, AN/FQ 3

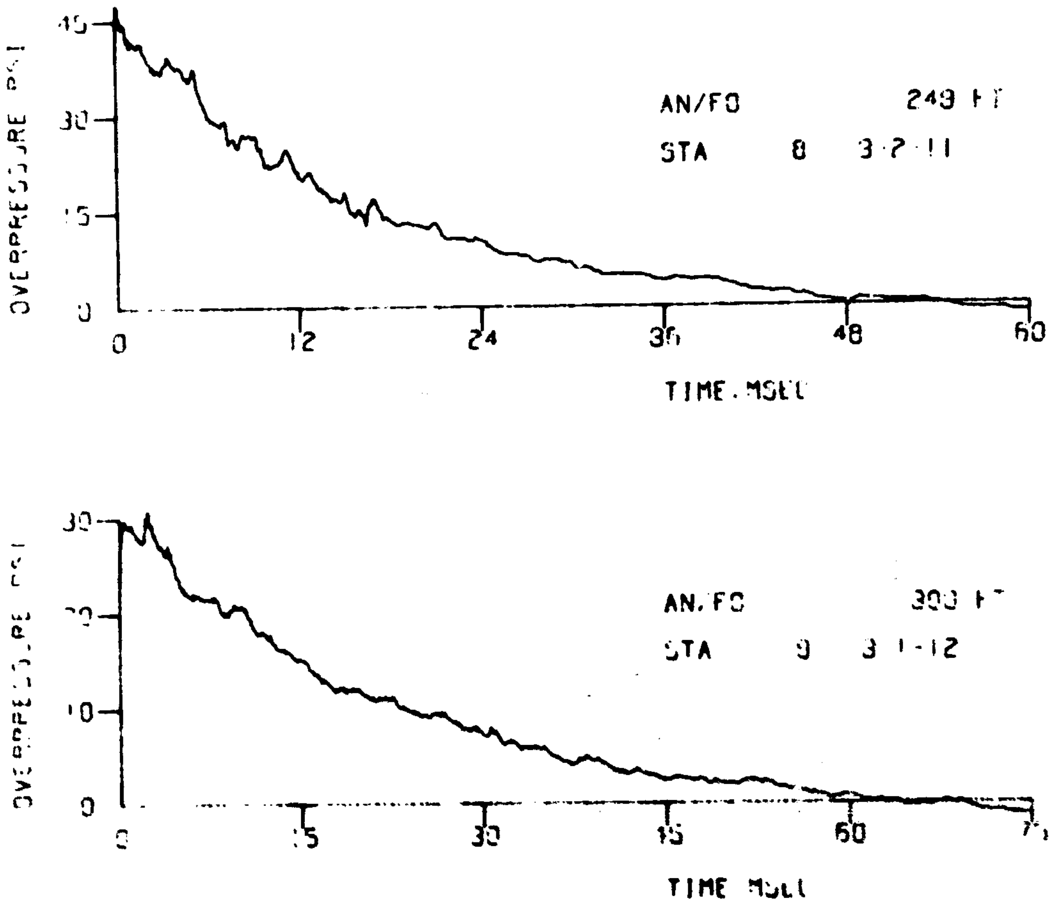

Figure A.7 Overpressure-Time Records, Stations 8-9, AN/FO 3

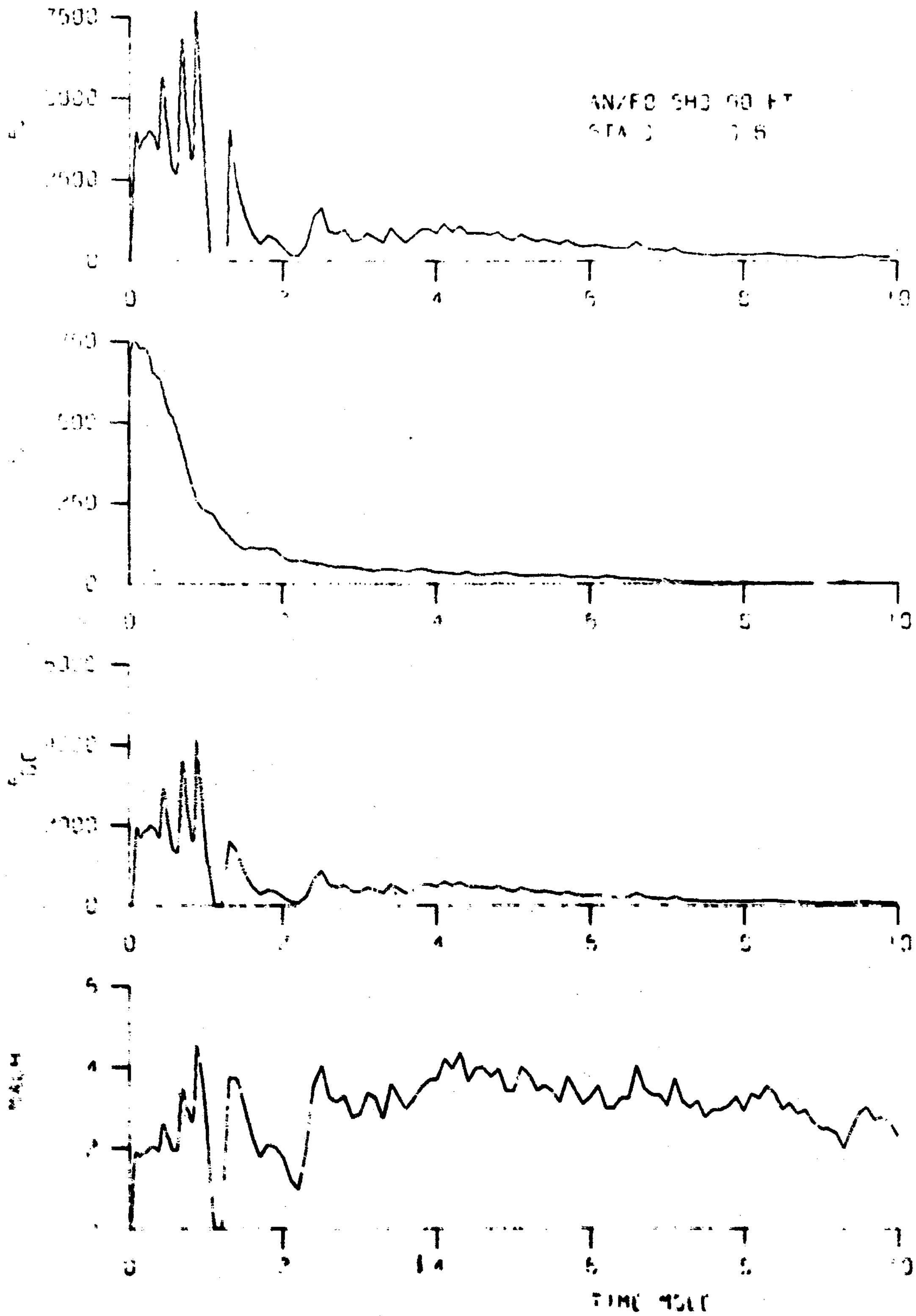

Figure A.8 Dynamic Pressure Data, Station 3, AN/FO 3

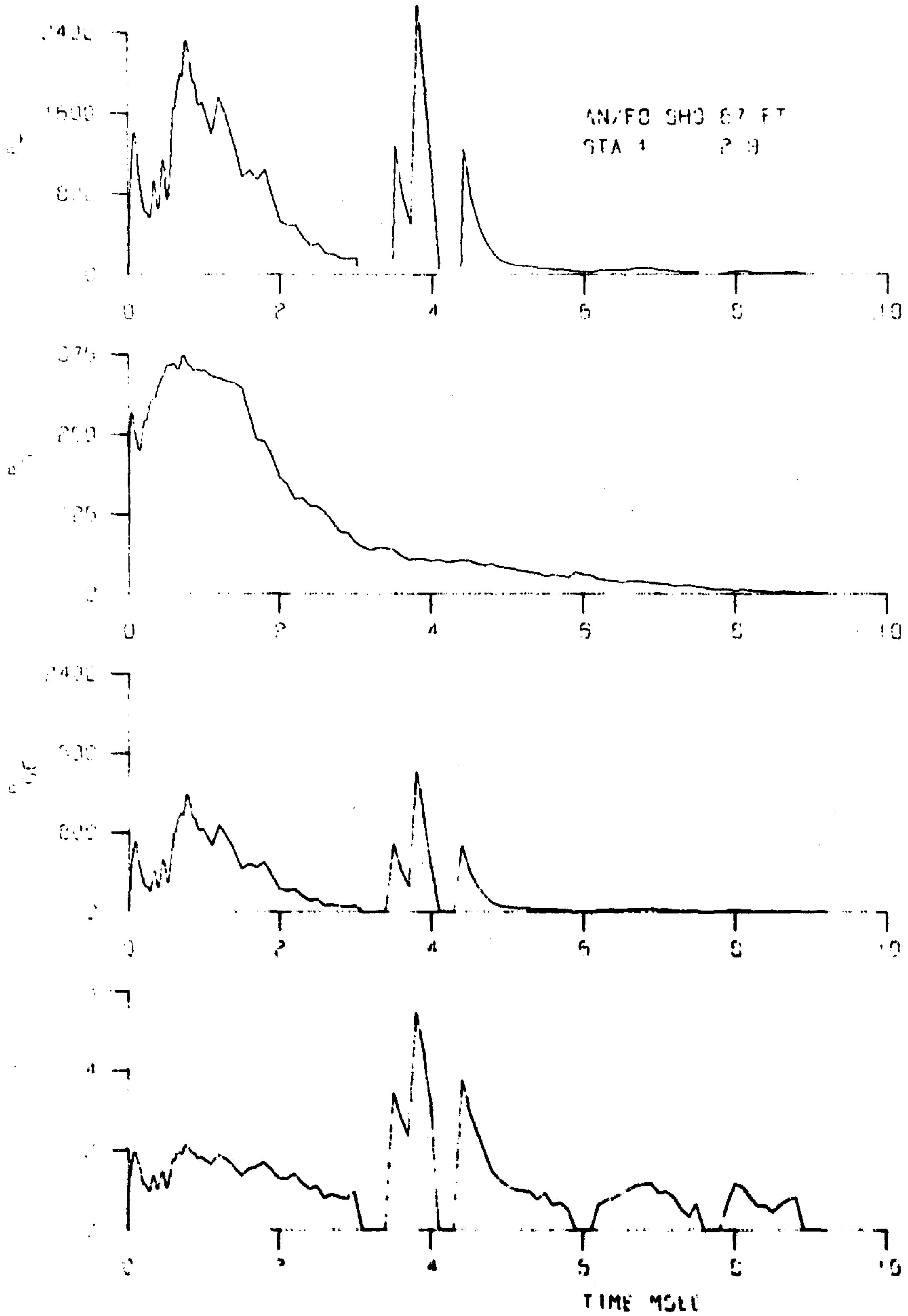

Figure A.9 Dynamic Pressure Data, Station 4, AN/FO: 3

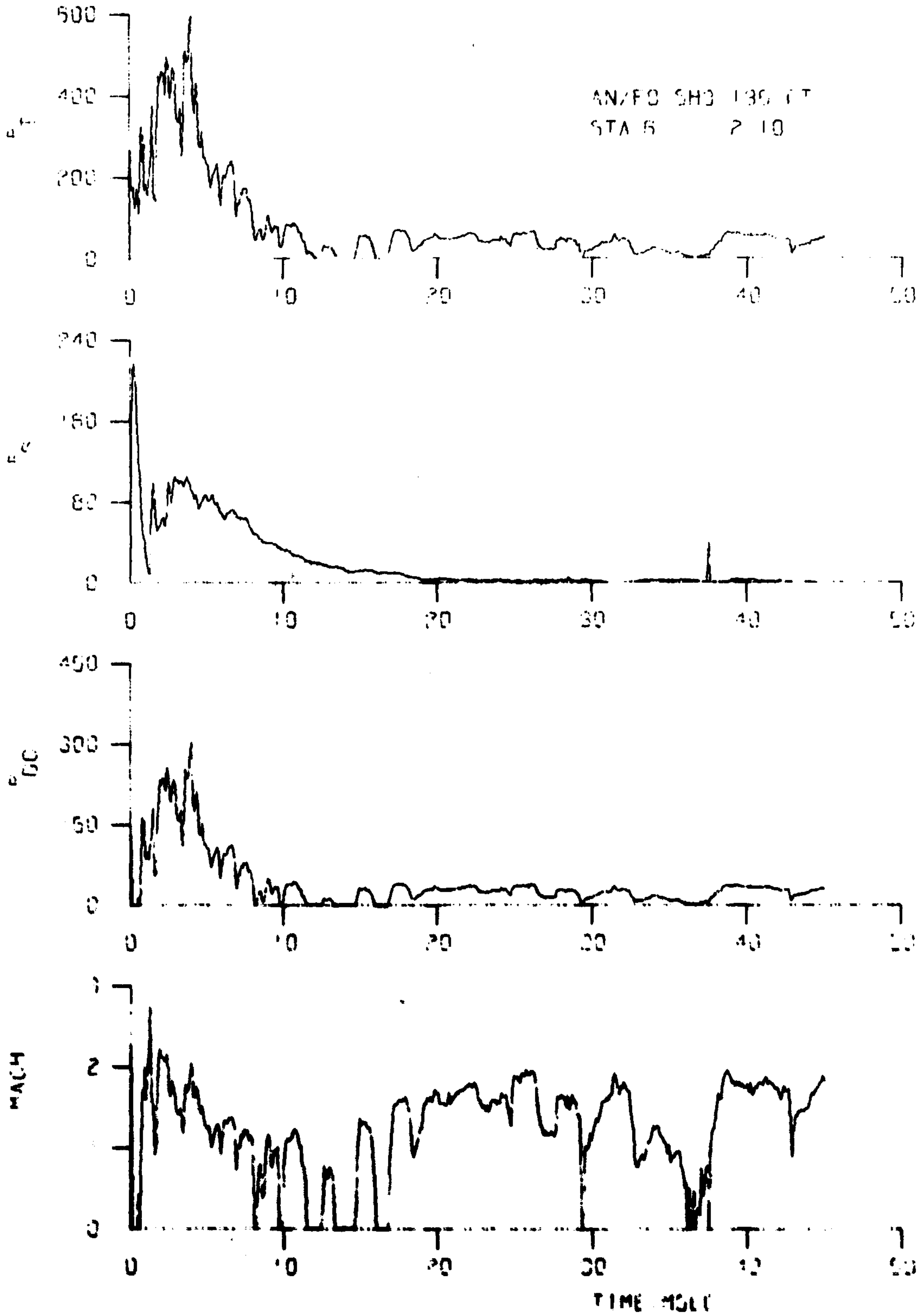

Figure A.10 Dynamic Pressure Data, Station 6, AN/FO 3

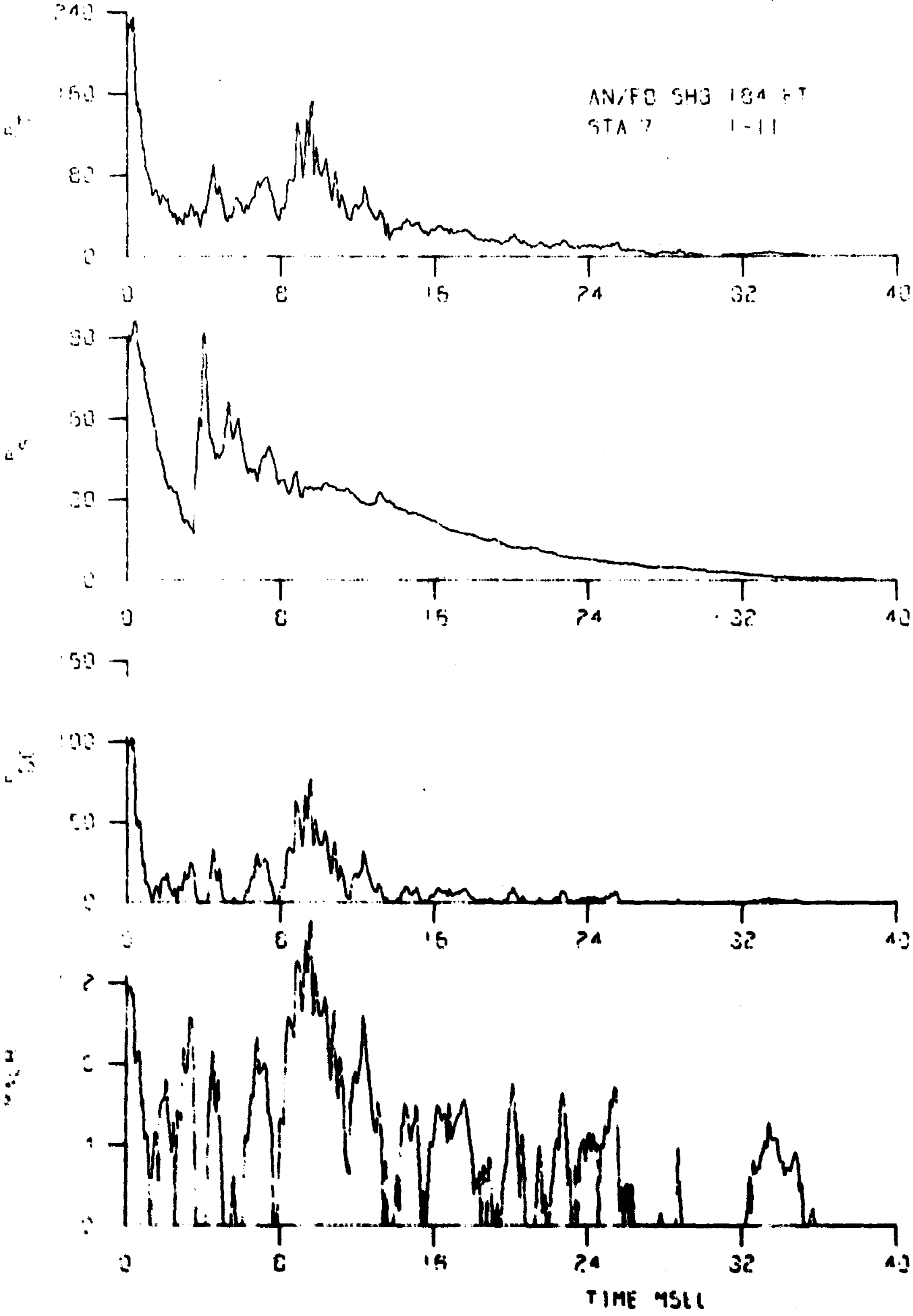

Figure A.11 Dynamic Pressure Data, Station 7, AN/FO 3

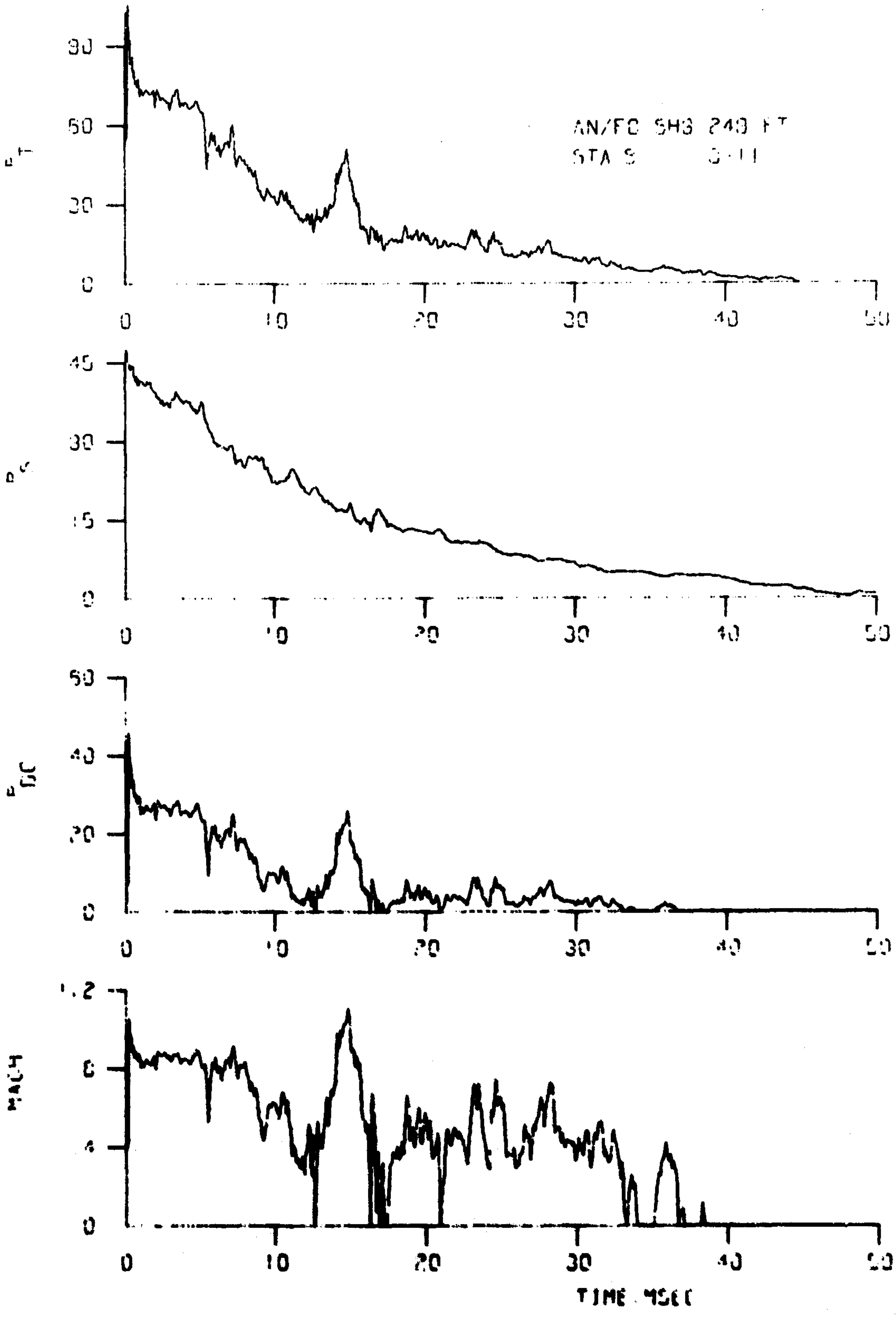

Figure A.12 Dynamic Pressure Data, Station 8, AN/PO: 3

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13. ABSTRACT

Air blast was measured from the detonation of three hemispherical ammonium nitrate fuel oil charges of 20 ton and 100 ton magnitude. Strain-type pressure transducers with magnetic tape recording systems were used to record the air blast parameters over the moderate to high pressure region. Comparison made with hemispherical TNT data shows an effective weight 0.83 of TNT on the basis of overpressure measurements in the 200 to 30 psi region. (U)

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	ROLE	WT	ROLE	WT	ROLE	WT
Detonation Air blast Transducers Overpressure Positive Duration Overpressure Impulse Shock Arrival						